

## APPENDIX A

### ASSESSMENT METHODOLOGY GUIDELINES FOR EVALUATING DESIGNATED USE STATUS OF MASSACHUSETTS SURFACE WATERS - 2007

The Clean Water Act (CWA) Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. By this process, states report on waterbodies within the context of meeting their designated uses. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary Contact Recreation, Secondary Contact Recreation, Shellfish Harvesting and Aesthetics*. Two subclasses of Aquatic Life are also designated in the Massachusetts Surface Water Quality Standards (SWQS): Cold Water Fishery – waters capable of sustaining a year-round population of cold water aquatic life, such as trout – and Warm Water Fishery – waters that are not capable of sustaining a year-round population of cold water aquatic life (MassDEP 2006).

The SWQS, summarized in Table A1, prescribe minimum water quality criteria to sustain the designated uses. Furthermore, these standards describe the hydrological conditions at which water quality criteria must be applied (MassDEP 2006). In rivers the lowest flow conditions at and above which aquatic life criteria must be applied are the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In waters where flows are regulated by dams or similar structures, the lowest flow conditions at which aquatic life criteria must be applied are the flows equal to or exceeded 99% of the time on a yearly basis or another equivalent flow that has been agreed upon (see Mass DEP 2006 for more detail). In coastal and marine waters and for lakes, the Massachusetts Department of Environmental Protection (MassDEP) will determine on a case-by-case basis the most severe hydrological condition for which the aquatic life criteria must be applied.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any individual or group performing work for or on behalf of EPA establish a quality system to support the development, review, approval, implementation, and assessment of data collection operations. To this end MassDEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the MassDEP are of known and documented quality and are suitable for their intended use. For external sources of information, MassDEP requires the following: 1) an appropriate Quality Assurance Project Plan (QAPP) including a laboratory Quality Assurance /Quality Control (QA/QC) plan; 2) use of a state certified lab (or as otherwise approved by DEP for a particular analysis); and 3) sample data, QA/QC and other pertinent sample handling information documented in a citable report. This information will be reviewed by MassDEP to determine its validity and usability to assess water use support. Data use could be modified or rejected due to poor or undocumented QAPP implementation, lack of project documentation, incomplete reporting of data or information, and/or project monitoring objectives unsuitable for MassDEP assessment purposes.

EPA provides guidelines to states for making their use support determinations (EPA 1997 and 2002, Grubbs and Wayland III 2000 and Wayland III 2001). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered “historical” and used for descriptive purposes they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table A1) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance from available literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton). Excursions from criteria due solely to “naturally occurring” conditions (e.g., low pH in some areas) do not constitute violations of the SWQS.

Each designated use within a given segment is individually assessed as **support** or **impaired**. When too little current data/information exist or no reliable data are available, the use is **not assessed**. In this report, however, if there is some indication that water quality impairment may exist, and it is not “naturally occurring”, the use is identified with an “Alert Status”. It is important to note that not all waters are assessed. Many small and/or unnamed ponds, rivers, and estuaries have **never been assessed**; the status of their designated uses has never been reported to EPA in the Commonwealth's 305(b) Report or the Integrated List of Waters nor is information on these waters maintained in the waterbody system database (WBS) or the new assessment database (ADB).

Table A1. Summary of Massachusetts Surface Water Quality Standards (MassDEP 2006, MA DPH 2002, FDA 2003).

Dissolved Oxygen	<p><u>Class A and Class B Cold Water Fishery (BCWF) and Class SA:</u> <math>\geq 6.0</math> mg/L</p> <p><u>Class A and Class B Warm Water Fishery (BWFF) and Class SB:</u> <math>\geq 5.0</math> mg/L</p> <p><u>Class C:</u> Not <math>&lt; 5.0</math> mg/L at least 16 hours of any 24-hour period and not <math>&lt; 3.0</math> mg/L at any time.</p> <p><u>Class SC:</u> Not <math>&lt; 5.0</math> mg/L at least 16 hours of any 24-hour period and not <math>&lt; 4.0</math> mg/L anytime.</p> <p>For all classes, where natural background conditions are lower than the criteria stated for each class, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall also be maintained.</p>
Temperature	<p><u>Class A CWF:</u> <math>\leq 68^{\circ}\text{F}</math> (<math>20^{\circ}\text{C}</math>) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring and <math>\Delta T</math> due to a discharge <math>\leq 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>).</p> <p><u>Class A WWF:</u> <math>\leq 83^{\circ}\text{F}</math> (<math>28.3^{\circ}\text{C}</math>) and <math>\Delta T</math> due to a discharge <math>\leq 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>).</p> <p><u>Class BCWF:</u> <math>\leq 68^{\circ}\text{F}</math> (<math>20^{\circ}\text{C}</math>) based on the mean of the daily maximum temperature over a seven day period in all cold water fisheries, unless naturally occurring, and <math>\Delta T</math> due to a discharge <math>\leq 3^{\circ}\text{F}</math> (<math>1.7^{\circ}\text{C}</math>)</p> <p><u>Class BWFF:</u> <math>\leq 83^{\circ}\text{F}</math> (<math>28.3^{\circ}\text{C}</math>) and <math>\Delta T</math> due to a discharge <math>\leq 5^{\circ}\text{F}</math> (<math>2.8^{\circ}\text{C}</math>) in rivers (based on the minimum expected flow for the month) and <math>\Delta T</math> due to a discharge <math>\leq 3^{\circ}\text{F}</math> (<math>1.7^{\circ}\text{C}</math>) in the epilimnion (based on the monthly average of maximum daily temperatures) in lakes,</p> <p><u>Class C and Class SC:</u> <math>\leq 85^{\circ}\text{F}</math> (<math>29.4^{\circ}\text{C}</math>) and <math>\Delta T</math> due to a discharge <math>\leq 5^{\circ}\text{F}</math> (<math>2.8^{\circ}\text{C}</math>)</p> <p><u>Class SA:</u> <math>\leq 85^{\circ}\text{F}</math> (<math>29.4^{\circ}\text{C}</math>) nor a maximum daily mean of <math>80^{\circ}\text{F}</math> (<math>26.7^{\circ}\text{C}</math>) and <math>\Delta T</math> due to a discharge <math>\leq 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>)</p> <p><u>Class SB:</u> <math>\leq 85^{\circ}\text{F}</math> (<math>29.4^{\circ}\text{C}</math>) nor a maximum daily mean of <math>80^{\circ}\text{F}</math> (<math>26.7^{\circ}\text{C}</math>) and <math>\Delta T</math> due to a discharge <math>\leq 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>) between July and September and <math>\leq 4.0^{\circ}\text{F}</math> (<math>2.2^{\circ}\text{C}</math>) between October and June.</p> <p><i>For all classes, natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any uses assigned to each class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.</i></p> <p><i>For CWF waters, where a reproducing cold water aquatic community exists at a naturally higher temperature, the temperature necessary to protect the community shall not be exceeded and natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained.</i></p> <p><u>Class B, C, SA, SB, and SC:</u> See MassDEP 2006 for language specific to alternative effluent limitations relating to thermal discharges and cooling water intake structures.</p>
pH	<p><u>Class A, Class BCWF and Class BWFF:</u> 6.5 - 8.3 SU and <math>\Delta 0.5</math> outside the natural background range.</p> <p><u>Class C:</u> 6.5 - 9.0 SU and <math>\Delta 1.0</math> outside the natural background range.</p> <p><u>Class SA and Class SB:</u> 6.5 - 8.5 SU and <math>\Delta 0.2</math> SU outside the natural background range.</p> <p><u>Class SC:</u> 6.5 - 9.0 SU and <math>\Delta 0.5</math> SU outside the natural background range.</p> <p>There shall be no change from natural background conditions that would impair any use assigned to each class.</p>
Solids	<p><u>All Classes:</u> These waters shall be free from floating, suspended, and settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.</p>
Color and Turbidity	<p><u>All Classes:</u> These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.</p>
Oil and Grease	<p><u>Class A and Class SA:</u> Waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.</p> <p><u>Class SA:</u> Waters shall be free from oil and grease and petrochemicals.</p> <p><u>Class B, Class C, Class SB and Class SC:</u> Waters shall be free from oil, grease, and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.</p>
Taste and Odor	<p><u>Class A and Class SA:</u> None other than of natural origin.</p> <p><u>Class B, Class C, Class SB and Class SC:</u> None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.</p>
Aesthetics	<p><u>All Classes:</u> All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.</p>

Table A1 (continued). Summary of Massachusetts Surface Water Quality Standards (MassDEP 2006, MA DPH 2002, FDA 2003).

Toxic Pollutants	<i>All Classes: All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822-R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction (see Mass DEP 2006 for more detail regarding permit limits, conversion factors, site specific criteria).</i>
Nutrients	<i>Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to these Standards.</i>
<p>Bacteria (MassDEP 2006 and MA DPH 2002)</p> <p>Class A criteria apply to the <i>Drinking Water Use</i>.</p> <p>Class B and SB criteria apply to <i>Primary Contact Recreation Use</i> while Class C and SC criteria apply to <i>Secondary Contact Recreation Use</i>.</p>	<p><u>Class A:</u> <i>At water supply intakes in unfiltered public water supplies: either fecal coliform shall not exceed 20 organisms/100 ml in all samples taken in any six month period, or total coliform shall not exceed 100 organisms/ 100 ml in 90% of the samples taken in any six month period. If both total and fecal coliform are measured, then only the fecal coliform criterion must be met.</i></p> <p><u>Class A other waters, Class B:</u> Where <i>E. coli</i> is the chosen indicator at public bathing beaches as defined by MA DPH: The geometric mean of the five most recent <i>E. coli</i> samples taken within during the same bathing season shall not exceed 126 colonies/ 100 ml and no single sample taken during the bathing season shall exceed 235 colonies/ 100 ml (these criteria may be applied on a seasonal basis at the Department's discretion). Where Enterococci are the chosen indicators at public bathing beaches: The geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies /100 ml and no single <i>Enterococci</i> sample taken during the bathing season shall exceed 61 colonies /100 ml.</p> <p>For other waters and, during the non bathing season, for waters at public bathing beaches: The geometric mean of all <i>E. coli</i> samples taken within the most recent six months shall not exceed 126 colonies/ 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies/ 100 ml. These criteria may be applied on a seasonal basis at the Department's discretion.</p> <p>The geometric mean of all <i>Enterococci</i> samples taken within the most recent six months shall not exceed 33 colonies/ 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies/ 100 ml. These criteria may be applied on a seasonal basis at the Department's discretion.</p> <p><u>Class C:</u> <i>The geometric mean of all E. coli samples taken within the most recent six months shall not exceed 630 E. coli/ 100 ml, typically based on a minimum of five samples and 10% of such samples shall not exceed 1260 E. coli/ 100 ml. This criterion may be applied on a seasonal basis at the discretion of the Department.</i></p> <p><u>Class SA:</u> Waters designated for shellfishing: <i>Fecal coliform bacteria shall not exceed a geometric mean (Most Probable Number (MPN) method) of 14 organisms/100 ml, nor shall more than 10% of the samples exceed an MPN of 28 organisms/100 ml, or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide for the Control of Molluscan Shellfish Areas (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5)).</i></p> <p><u>Class SB:</u> Waters designated for shellfishing: <i>Fecal coliform median or geometric mean MPN shall not exceed 88 organisms/100 ml, nor shall more than 10% of the samples exceed an MPN of 260 organisms/100 ml or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide for the Control of Molluscan Shellfish Areas (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5)).</i></p>

	<p><u>Class SA and Class SB:</u></p> <p>At public bathing beaches, as defined by MA DPH:</p> <p>No single <i>Enterococci</i> sample taken during the bathing season shall exceed 104 colonies /100 ml and the geometric mean of the five most recent <i>Enterococci</i> samples taken within the same bathing season shall not exceed 35 colonies /100 ml.</p> <p>At public bathing beaches during the non-bathing season and in non bathing beach waters:</p> <p>No single <i>Enterococci</i> sample shall exceed 104 colonies/ 100 ml and the geometric mean of all samples taken within the most recent six months, typically a minimum of five samples, shall not exceed 35 colonies/ 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department).</p> <p><u>Class SC:</u></p> <p><i>The geometric mean of all Enterococci samples taken within the most recent six months shall not exceed 175 colonies/ 100 ml, typically based on the five most recent samples, and 10% of such samples shall not exceed 350 colonies/ 100 ml. This criterion may be applied on a seasonal basis at the discretion of the Department.</i></p>
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*Note: Italics are direct quotations.*

Δ criterion (referring to a change from natural background conditions) is applied to the effects of a permitted discharge.

## DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MassDEP 2006):

- *AQUATIC LIFE* - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna, including, but not limited to, wildlife and threatened and endangered species and for their reproduction, migration, growth and other critical functions. Two subclasses of aquatic life are also designated in the standards for freshwater bodies: *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life, such as trout; *Warm Water Fishery* - waters that are not capable of sustaining a year-round population of cold water aquatic life. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass.
- *FISH CONSUMPTION* - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption.
- *DRINKING WATER* - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).
- *SHELLFISH HARVESTING* (in SA and SB segments) – Class SA waters where designated shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas); Class SB waters where designated shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas).
- *PRIMARY CONTACT RECREATION* - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.
- *SECONDARY CONTACT RECREATION* - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, including human consumption of fish, boating and limited contact incident to shoreline activities. Where designated, secondary contact recreation also includes shellfishing, including human consumption of shellfish. Human consumption of fish and shellfish are assessed as the *Fish Consumption* and *Shellfish Harvesting* uses, respectively.
- *AESTHETICS* - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *AGRICULTURAL AND INDUSTRIAL* - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

The guidance used to assess the *Aquatic Life*, *Fish Consumption*, *Drinking Water*, *Shellfish Harvesting*, *Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

Note: Waterbodies affected by Combined Sewer Overflow (CSO) discharges are qualified in the standards, however, unless a variance has been granted and states otherwise, excursions from criteria are not allowed during storm events (designated uses are still applicable).

## AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna, including, but not limited to, wildlife and threatened and endangered species and for their reproduction, migration, growth and other critical functions. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MassDEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support or impaired) of the *Aquatic Life Use*.

<b>Variable</b>	<b>Support</b> Data available clearly indicates support or minor modification of the biological community. Excursions from chemical criteria (Table A1) not frequent or prolonged and may be tolerated if the biosurvey results demonstrate support.	<b>Impaired</b> There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
<b>BIOLOGY</b>		
Rapid Bioassessment Protocol (RBP) III*	Non/Slightly impacted	Moderately or Severely Impacted
Fish Community	Best Professional Judgment (BPJ)	BPJ
Habitat and Flow	BPJ	Dewatered streambed due to artificial regulation or channel alteration, BPJ
Eelgrass Bed Habitat (Howes <i>et al.</i> 2003, Costello 2003)	Stable (No/minimal loss), BPJ	Loss/decline, BPJ
Non-native species	BPJ	Non-native species present, BPJ
Plankton/Periphyton	No/infrequent algal blooms	Frequent and/or prolonged algal blooms
<b>TOXICITY TESTS**</b>		
Water Column/Ambient	>75% survival either 48 hr or 7-day exposure	<75% survival either 48 hr or 7-day exposure
Sediment	≥75% survival	<75% survival
<b>CHEMISTRY-WATER**</b>		
Dissolved oxygen (DO) (MassDEP 2006, EPA 1997)	Infrequent excursion from criteria (Table A1), BPJ (minimum of three samples representing critical period)	Frequent and/or prolonged excursion from criteria [river and shallow lakes - exceedances >10% of representative measurements; deep lakes (with hypolimnion) - exceedances in the hypolimnetic area >10% of the surface area during maximum oxygen depletion].
pH (MassDEP 2006, EPA 1999a)	Infrequent excursion from criteria (Table A1)	Criteria exceeded >10% of measurements.
Temperature (MassDEP 2006, EPA 1997)	Infrequent excursion from criteria (Table A1) <sup>1</sup> CWF excursion based on mean of the daily maximum temperatures over a 7-day period.	Criteria exceeded >10% of measurements. CWF excursion based on mean of the daily maximum temperatures over a 7-day period.
Toxic Pollutants (MassDEP 2006, EPA 1999a) Ammonia-N (MassDEP 2006, EPA 1999b) Chlorine (MassDEP 2006, EPA 1999a)	Infrequent excursion from criteria (Table A1)  Ammonia is pH and temperature dependent <sup>2</sup>  0.011 mg/L (freshwater) or 0.0075 mg/L (saltwater) total residual chlorine (TRC) <sup>3</sup>	Frequent and/or prolonged excursion from criteria (exceeded >10% of measurements).
<b>CHEMISTRY-SEDIMENT**</b>		
Toxic Pollutants (Persaud <i>et al.</i> 1993)	Concentrations ≤ Low Effect Level (L-EL), BPJ	Concentrations ≥ Severe Effect Level (S-EL) <sup>4</sup> , BPJ
<b>CHEMISTRY-TISSUE</b>		
PCB – whole fish (Coles 1998)	≤500 µg/kg wet weight	BPJ
DDT (Environment Canada 1999)	≤14.0 µg/kg wet weight	BPJ
PCB in aquatic tissue (Environment Canada 1999)	≤0.79 ng TEQ/kg wet weight	BPJ

\*RBP II analysis may be considered for assessment decision on a case-by-case basis, \*\*For identification of impairment, one or more of the following variables may be used to identify possible causes/sources of impairment: NPDES facility compliance with whole effluent toxicity test and other limits, turbidity and suspended solids data, nutrient (nitrogen and phosphorus) data for water column/sediments. <sup>1</sup>Maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion. <sup>2</sup>Saltwater is temperature dependent only. <sup>3</sup>The minimum quantification level for TRC is 0.05 mg/L. <sup>4</sup>For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (PCB) in sediment (which varies with Total Organic Carbon (TOC) content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

Note: National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500µg/kg wet weight (ppb, not lipid-normalized). PCB data (tissue) in this report are presented in µg/kg wet weight (ppb) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

## **FISH CONSUMPTION USE**

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MA DPH), Bureau of Environmental Health Assessment (MA DPH 2007). The MA DPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species pose a health risk for human consumption. Hence, the *Fish Consumption Use* is assessed as impaired in these waters.

In July 2001, MA DPH issued new consumer advisories on fish consumption and mercury contamination (MA DPH 2001).

1. The MA DPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MA DPH 2001)."
2. Additionally, MA DPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MA DPH 2001)."

Other statewide advisories that MA DPH has previously issued and are still in effect are as follows (MA DPH 2001):

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCB) and other contaminants, no individual should consume lobster tomalley from any source. Lobster tomalley is the soft green substance found in the tail and body section of the lobster.
2. Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

The following is an overview of EPA's guidance used to assess the status (support or impaired) of the *Fish Consumption Use*. Because of the statewide advisory no waters can be assessed as support for the *Fish Consumption Use*. Therefore, if no site-specific advisory is in place, the *Fish Consumption Use* is not assessed.

<b>Variable</b>	<b>Support</b> No restrictions or bans in effect	<b>Impaired</b> There is a "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species or there is a commercial fishing ban in effect.
MA DPH Fish Consumption Advisory List	Not applicable, precluded by statewide advisory (Hg)	Waterbody on MA DPH Fish Consumption Advisory List

Note: MA DPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

**Northeast Regional Mercury TMDL:** On 20 December 2007 the U.S. EPA approved the Northeast Regional Mercury Total Maximum Daily Load (TMDL). This TMDL is a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards. It was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers inland waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new on-going monitoring and air deposition data. Final targets will be determined at that time.

## **DRINKING WATER USE**

The term *Drinking Water Use* denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). MassDEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act (SDWA). Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) all public drinking water supplies are monitored as finished water (tap water). Monitoring includes the major categories of contaminants established in the SDWA: bacteria, volatile and synthetic organic compounds, inorganic compounds and radionuclides. The DWP maintains current drinking supply monitoring data. The suppliers currently report to MassDEP and EPA the status of the supplies on an annual basis in the form of a consumer confidence report (<http://yosemite.epa.gov/ogwdw/ccr.nsf/Massachusetts>). Below is EPA's guidance to assess the status (support or impaired) of the drinking water use.

<b>Variable</b>	<b>Support</b>	<b>Impaired</b>
	No closures or advisories (no contaminants with confirmed exceedances of maximum contaminant levels, conventional treatment is adequate to maintain the supply).	Has one or more advisories or more than conventional treatment is required or has a contamination-based closure of the water supply.
Drinking Water Program (DWP) Evaluation	See note below	See note below

Note: While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at <http://www.mass.gov/dep/water/drinking.htm> and from local public water suppliers.

## **SHELLFISHING USE**

This use is assessed using information from the Department of Fish and Game's Division of Marine Fisheries (DMF). A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (described below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed*. Not enough testing has been done in these areas to determine whether or not they are fit for shellfish harvest, therefore, they are closed for the harvest of shellfish.

<b>Variable</b>	<b>Support</b>	<b>Impaired</b>
	SA Waters: Approved <sup>1</sup> SB Waters: Approved <sup>1</sup> , Conditionally Approved <sup>2</sup> , or Restricted <sup>3</sup>	SA Waters: Conditionally Approved <sup>2</sup> , Restricted <sup>3</sup> , Conditionally Restricted <sup>4</sup> , or Prohibited <sup>5</sup> SB Waters: Conditionally Restricted <sup>4</sup> or Prohibited <sup>5</sup>
DMF Shellfish Project Classification Area Information (MA DFG 2000)	Reported by DMF	Reported by DMF

NOTE: Designated shellfish growing areas may be viewed using the MassGIS datalayer available from MassGIS at <http://www.mass.gov/mgis/dsga.htm>. This coverage currently reflects classification areas as of July 1, 2000.

<sup>1</sup> **Approved** - "...open for harvest of shellfish for direct human consumption subject to local rules and regulations..." An approved area is open all the time and closes only due to hurricanes or other major coastwide events.

<sup>2</sup> **Conditionally Approved** - "...subject to intermittent microbiological pollution..." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations..." A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area.

<sup>3</sup> **Restricted** - area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area.

<sup>4</sup> **Conditionally Restricted** - "...subject to intermittent microbiological pollution..." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft-shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification).

<sup>5</sup> **Prohibited** - Closed for harvest of shellfish.



## **PRIMARY CONTACT RECREATION USE**

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water during the primary contact recreation season (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support or impaired) of the *Primary Contact Recreation Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

<b>Variable</b>	<b>Support</b> Criteria are met, no aesthetic conditions that preclude the use	<b>Impaired</b> Frequent or prolonged violations of criteria and/or formal bathing area closures, or severe aesthetic conditions that preclude the use
Bacteria (105 CMR 445.000) Minimum Standards for Bathing Beaches State Sanitary Code) (MassDEP 2006)	At "public bathing beach" areas: Formal beach postings/advisories neither frequent nor prolonged during the swimming season (the number of days posted or closed cannot exceed 10% during the locally operated swimming season).  Collected samples* meet criteria (Table A1).  Shellfish Growing Area classified as "Approved by DMF.	At "public bathing beach" areas: Formal beach closures/postings >10% of time during swimming season (the number of days posted or closed exceeds 10% during the locally operated swimming season).  Collected samples* do not meet the criteria (Table A1).
<b>Aesthetics (MassDEP 1996) - All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance [growth or amount] species of aquatic life</b>		
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MA DPH 1969)	Public bathing beach and lakes – Secchi disk depth $\geq 1.2$ meters ( $\geq 4'$ ) (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth $< 1.2$ meters ( $< 4'$ ) (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

\* Data sets to be evaluated for assessment purposes must be representative of a sampling location (at least five samples per station recommended) and the season being analyzed, as described in the SWQS (see Table 1). Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use. Because of low sample frequency (i.e., less than ten samples per station) an impairment decision will not be based on a single sample exceedance (i.e., the geometric mean of five samples is  $< 126$  *E. coli* colonies/100 ml but one of the five sample exceeds 235 *E. coli* colonies/100 ml). The method detection limit (MDL) will be used in the calculation of the geometric mean when data are reported as less than the MDL (e.g., use 20 cfu/100 ml if the result is reported as  $< 20$  cfu/100 ml). Those data reported as too numerous to count (TNTC) will not be used in the geometric mean calculation; however frequency of TNTC sample results should be presented.

\*\*Waters

## SECONDARY CONTACT RECREATION USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support or impaired) of the *Secondary Contact Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

<b>Variable</b>	<b>Support</b> Criteria are met, no aesthetic conditions that preclude the use	<b>Impaired</b> Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Bacteria (MassDEP 2006)	Collected samples* meet the Class C or SC criteria (see Table A1).  Shellfish Growing Area classified as "Approved" by DMF.	Collected samples* do not meet the Class C or SC criteria (see Table A1).
<i>Aesthetics (MassDEP 2006) - All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance [growth or amount] species of aquatic life</i>		
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MA DPH 1969)	Public bathing beach and lakes – Secchi disk depth $\geq 1.2$ meters ( $\geq 4'$ ) (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth $< 1.2$ meters ( $< 4'$ ) (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

\*Data sets to be evaluated for assessment purposes must be representative of a sampling location (at least five samples per station recommended) over time. Because of low sample frequency (i.e., less than ten samples per station) an impairment decision will not be based on a single sample exceedance. Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use.

## AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support or impaired) of the *Aesthetics Use*.

<b>Variable</b>	<b>Support</b> Narrative "free from" criteria met	<b>Impaired</b> Objectionable conditions frequent and/or prolonged
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MA DPH 1969)	Public bathing beach and lakes – Secchi disk depth $\geq 1.2$ meters ( $\geq 4'$ ) (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth $< 1.2$ meters ( $< 4'$ ) (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

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Appendix B

Technical Memorandum 34-5

**CONNECTICUT RIVER WATERSHED  
DWM 2003 WATER QUALITY MONITORING DATA**

DWM Control Number: CN 105.2

Prepared by  
Peter Mitchell

**COMMONWEALTH OF MASSACHUSETTS  
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## Introduction

Water quality sampling of the Connecticut River Watershed was conducted in April - September 2003, "Year Two" of MassDEP's five-year rotating watershed monitoring and management schedule. The primary objective of this "Year Two" sampling, as outlined in *CN 127.0 Quality Assurance Project Plan: 2003, Monitoring in the Blackstone, Chicopee, Connecticut and Nashua Watersheds* (MassDEP / DWM 2003), was to obtain sufficient data to determine the status of selected mainstem segments and tributaries with regard to their attainment of the Massachusetts Surface Water Quality Standards and designated uses.

The DWM sampling plan matrix for the monitoring in the Connecticut Watershed is presented in Table 1. Sampling components at river stations included: *insitu* Multi-probe<sup>®</sup> measurements, and physicochemical, nutrient, and bacteria sampling.

This technical memorandum presents the water quality sampling component of the survey. Results of other monitoring efforts, such as biological assessments and monitoring to support the development of lake Total Maximum Daily Loads, are reported in separate technical memoranda.

## Methods

Water quality samples were collected in the Connecticut River Watershed on the dates and for the parameters shown in Table 1 (see Figure 1 for station locations). The parameters included in the sampling were: *insitu* Multi-probe<sup>®</sup> measurements (dissolved oxygen, percent dissolved oxygen saturation, pH, conductivity, water temperature and total dissolved solids), and total suspended solids, ammonia - nitrogen, nitrate – nitrite - nitrogen, total phosphorus, chlorophyll-a, and fecal coliform and *E. coli* bacteria (Table 1). The water quality sampling procedures are included in the publication: *CN 001.2 Sample Collection Techniques for DWM Surface Water Quality Monitoring* (Chase 2003a). Standard operating procedure *CN 004.2 Standard operating procedure: Water Quality Multi-probes* (Haynes *et al.* 2001) outlines the standard operating procedures for multi-probe sampling. Samples for total suspended solids, turbidity, fecal coliform and *E. coli* bacteria were analyzed at Severn Trent Laboratories, Inc., a private environmental testing lab in Westfield, Massachusetts, following their approved analytical laboratory SOPs. All other collected water chemistry samples were analyzed at the Division of Environmental Analysis Senator William X. Wall Experiment Station in Lawrence, MA.

## Quality Assurance and Control

DWM quality assurance and database management staff reviewed lab data reports and all multi-probe data. The data were validated and finalized per MassDEP / DWM data validation procedures, as described in standard operating procedure *CN 56.2 Data Validation and Usability* (Chase 2005a). In general, all water sample data were validated by reviewing QC sample results, analytical holding time compliance, QC sample frequency and related ancillary data/documentation (at a minimum). A complete summary of censoring and qualification decisions for 2003 DWM data is provided in *CN 211.0 Data Validation Report for Year 2002 Project Data* (Chase *et al.* 2005b). A list of symbols and qualifiers used for DWM data is presented in Appendix 3.

**TABLE 1: Connecticut River Watershed 2003 Water Quality Sampling Stations and Parameters**

Site Description	Station No.	April 30	June 4	July 9	Aug 6	Sept 10	Oct 1
Westfield River, Route 147 Bridge, Agawam / West Springfield	CT02	N1, T, TSS	N1, T, TSS	N1, T, TSS	N1, T, TSS	N2, T, TSS	N2, T, TSS
Deerfield River, Route 5 / 10 Bridge, Deerfield / Greenfield	CT04	N1, T, TSS	N1, T, TSS	N1, T, TSS	N1, T, TSS	N2, T, TSS	N2, T, TSS
Connecticut River, Route 10 Bridge, Northfield	CT06	B, N1, M, T, TSS	A/H, B, N1, M, T, TSS	A/H, B, C, N1, T, TSS	A/H, B, C, M, N1, T, TSS	B, C, M, N2, TSS	B, M, N2, TSS
Connecticut River, downstream of Fourmile Brook confluence, Northfield and east of Pisgah Mountain Road, Gill	02A	--	--	A/H, B, C, M, N1, T, TSS	A/H, B, C, M, N1, T, TSS	B, C, M, N2, TSS	--
Connecticut River, Route 116, Deerfield / Sunderland	04A	B, M, N1, T, TSS	A/H, B, M, N1, T, TSS	A/H, B, C, M, N1, T, TSS	A/H, B, C, M, N1, T, TSS	B, C, M, N2, TSS	--
Connecticut River, Upstream of the confluence with the Mill River, near the Oxbow, Northampton / Hadley	04C	--	--	A/H, B, C, M, N1, T, TSS	A/H, B, C, M, N1, T, TSS	B, C, M, N2, TSS	--
Connecticut River, Route 90, West Springfield / Chicopee	05A	--	--	A/H, B, C, M, N1, T, TSS	A/H, B, C, M, N1, T, TSS	B, C, M, N2, TSS	--
Connecticut River, at USGS gage 01184000, downstream of Route 190, Suffield / Enfield, CT	CT00	B, M, N1, T, TSS	A/H, B, M, N1, T, TSS	A/H, B, C, M, N1, T, TSS	M, C	B, C, M, N2, TSS	B, M, N2, T, TSS
Stony Brook, College Street (Route 116) upstream of confluence of Leaping Well Brook, South Hadley	19A	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, T, TSS
Bachelor Brook, Route 47, South Hadley	07A	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, T, TSS	B, C, M, N1, TSS	B, C, M, N1, T, TSS
Weston Brook, Rural Street, Belchertown	23A	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, T, TSS
Lampson Brook, George Hannum Street, approximately 50-feet downstream of Belchertown WWTP discharge, Belchertown	06A	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, T, TSS
Manhan River, Loudville Road, Easthampton	11A	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, T, TSS
Manhan River, Fort Hill Road, Easthampton	11C	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, T, TSS
Mill River, approximately 1 mile downstream of Clement Street and USGS gage 0117150, Northampton	28B	B, M, N1, T, TSS	B, M, N1, T, TSS	B, N1, T, TSS	B, M, N1, T, TSS	B, M, N2, TSS	B, M, N2, TSS
East Branch Mill River, south of East Main Street, approximately 200 feet upstream of confluence with West Branch Mill River, Williamsburg	EBMR01	B, M, N1, T, TSS	B, M, N1, T, TSS	B, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, TSS	B, M, N1, TSS
West Branch Mill River, Mill Street, Williamsburg	WBMR01	B, M, N1, T, TSS	B, M, N1, T, TSS	B, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, TSS	B, M, N1, TSS
Fort River, Route 47, Hadley	27B	B, M, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, T, TSS
Mill River, Maple Street, Hatfield	24B	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, TSS	B, M, N1, TSS
Bloody Brook, Whatley Road, Deerfield	BB01	B, M, N1, T, TSS	B, M, N1, T, TSS	B, N1, T, TSS	B, C, M, N1, T, TSS	B, C, M, N1, TSS	B, M, N1, TSS
Mill River, Mill River Lane, Hadley	25C	B, M, N1, T, TSS	B, M, N1, T, TSS	B, C, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, TSS	B, M, N1, TSS
Sawmill River, South Ferry Road, Montague	26A	B, M, N1, T, TSS	B, M, N1, T, TSS	B, N1, T, TSS	B, M, N1, T, TSS	B, M, N1, TSS	B, M, N1, TSS
Millers River, Route 63 Bridge, Erving / Montague	CT05	N1, T, TSS	N1, T, TSS	N1, T, TSS	N1, T, TSS	N2, T, TSS	N2, T, TSS
Chicopee River, Route 116 Bridge, Chicopee	CT03	N1, T, TSS	N1, T, TSS	N1, T, TSS	N1, T, TSS	N2, T, TSS	N2, T, TSS

A/H = Alkalinity and Hardness

B = Bacteria (fecal coliform and *E.coli*)

C = Chlorophyll-a

M = Multi-probe (temperature, pH, conductance, total dissolved solids, dissolved oxygen)



**(Note:** Some multi-probe measurements were obtained on adjacent dates)

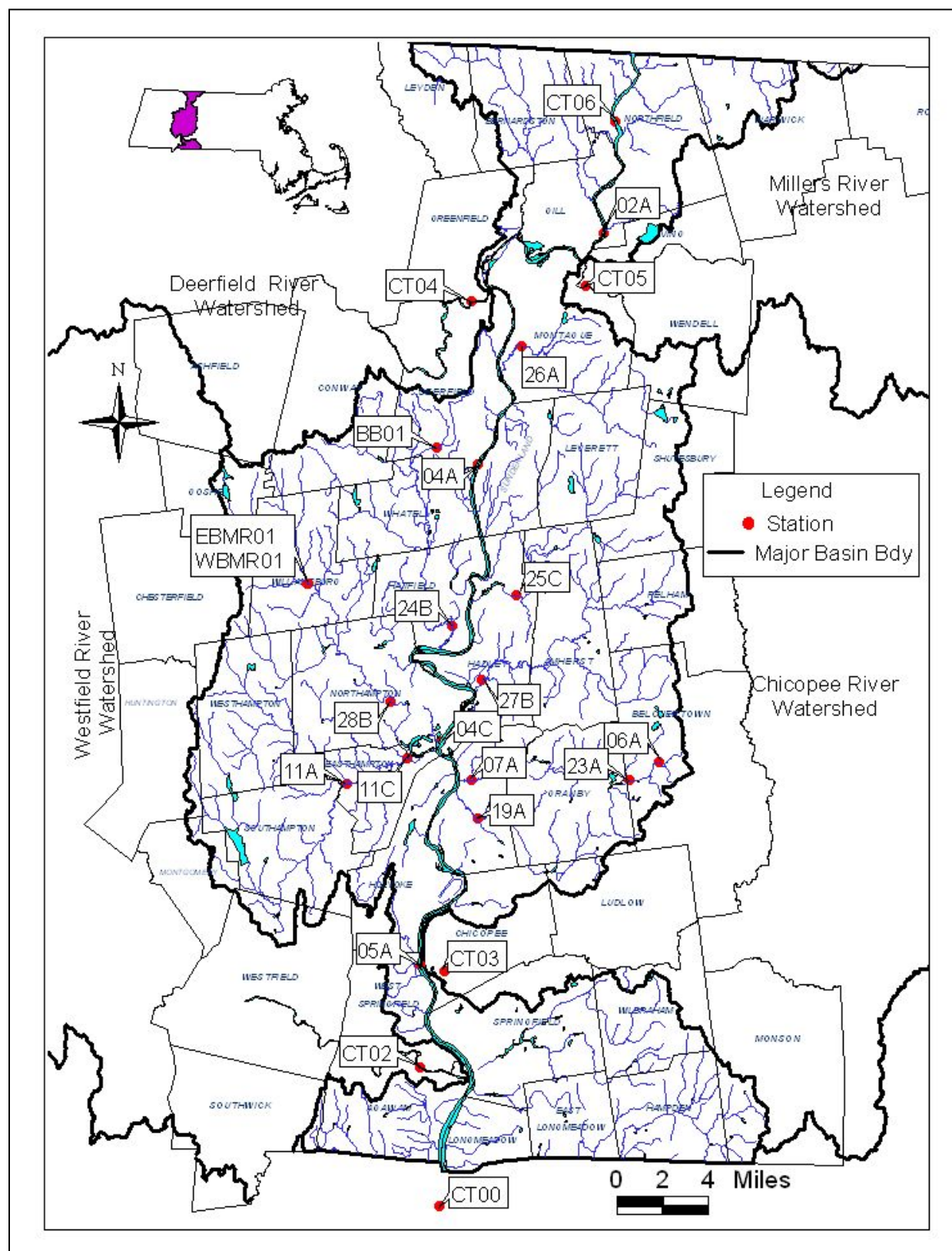
N1 = Ammonia – Nitrogen (NH<sub>3</sub>-N), Total phosphorous (TP)

N2 = Ammonia – Nitrogen (NH<sub>3</sub>-N), Total phosphorous (TP), Nitrate – Nitrite – Nitrogen (NO<sub>3</sub>-NO<sub>2</sub>-N),  
Total Nitrogen (TN)

T = Turbidity

TSS = Total suspended solids

**Figure 1: Connecticut River Watershed 2003 Water Quality Sampling Stations**



## Survey Conditions

Hydrological and meteorological conditions prior to each sampling event were characterized by examining discharge and precipitation data. Discharge data were obtained from USGS streamflow gages, and precipitation data from gauges (operated by MA DCR) proximal to the above streamflow gages.

### STREAMFLOW DATA

There are 25 active USGS gage stations in the Massachusetts portion of the greater Connecticut River Watershed (Socolow *et al.* 2004). These include gages in the Millers River Watershed (4), the Deerfield River Watershed (5), the Chicopee River Watershed (10), the Westfield River Watershed (3), and the Farmington River Watershed (1). There are two Connecticut River mainstem USGS gages in the Massachusetts portion of the Connecticut River Watershed (excluding the above major tributary rivers), and one mainstem Connecticut River gage 2.5-miles south of the Massachusetts / Connecticut boundary (Morrison *et al.* 2003). There is also one USGS gage on a small tributary (Mill River at Northampton, MA – 01171500) to the Connecticut River. Information pertaining to these latter four gages is presented below:

<u>Gage Number</u>	<u>Gage Description</u>
--------------------	-------------------------

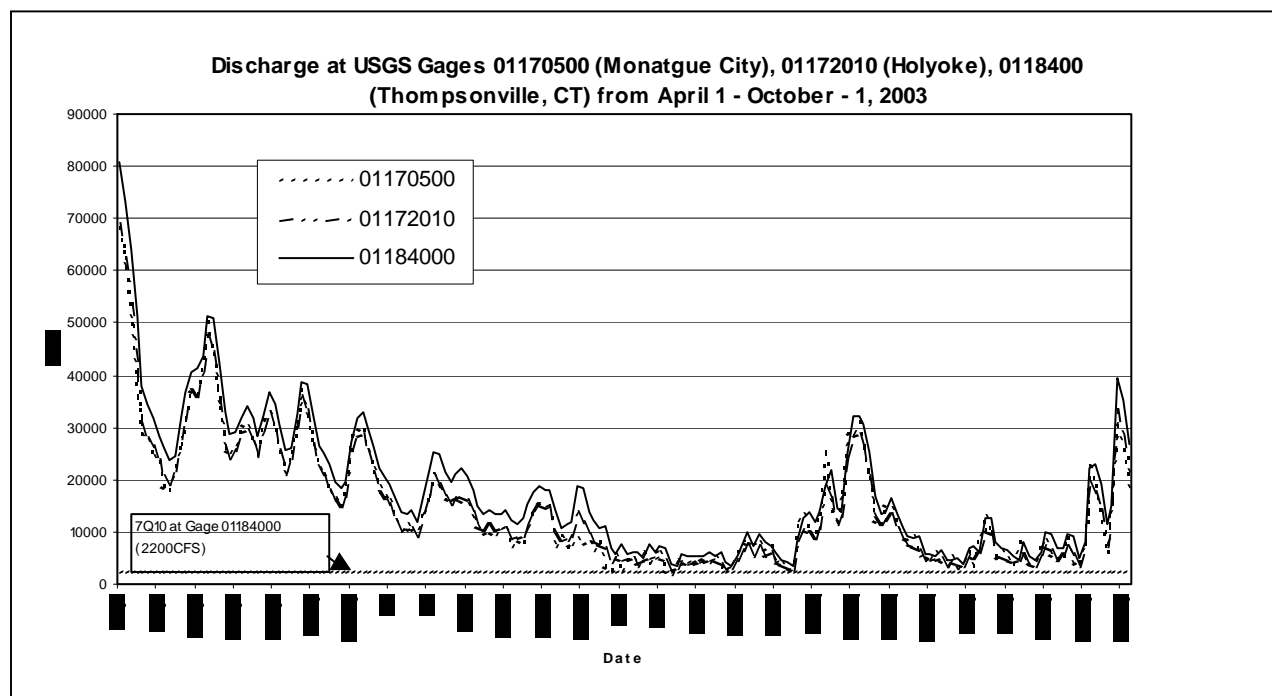
01170500	CONNECTICUT RIVER AT MONTAGUE CITY, MA Drainage Area: 7860 mi <sup>2</sup> *7Q10: 1727 cfs (Ries 1998)
01171500	MILL RIVER AT NORTHAMPTON, MA Drainage Area: 52.6 mi <sup>2</sup> 7Q10: 6.31 cfs (Ries 1998)
01172010	CONNECTICUT RIVER AT INTERSTATE 391 BRIDGE AT HOLYOKE, MA. Drainage Area: 8332 mi <sup>2</sup> 7Q10: not calculated
01184000	CONNECTICUT RIVER AT THOMPSONVILLE, CT Drainage Area: 9660 mi <sup>2</sup> 7Q10: 2200 cfs (Wandle 1984)

\*7Q10 is defined as the lowest stream flow for seven consecutive days that would be expected to occur once in ten years.

Streamflow data from gages 01170500, 01172010 and 01184000 may be used to describe flow conditions along the mainstem Connecticut River. Gage 01171500 measured streamflow from a run-of-river stream (Mill River, Northampton). These data may be used to estimate several flow conditions within the proximal, wadeable streams, and smaller rivers.

There are three dams along the mainstem of the Connecticut River that have the potential of modifying flow conditions within the river. They are: the Vernon Dam in Vermont, the Turner's Falls Dam in Turner's Falls, MA, and the Holyoke Dam in Holyoke, MA. The discharge measurements from the three mainstem Connecticut River USGS gage stations reveal a pronounced similarity (Figure 2). The discharge measurements were more than 95% correlated ( $p < 0.05$ ) with each other. Mainstem flow conditions between the USGS gage at Montague City and the USGS gage at Thompsonville, CT were consistent with run-of-river flow conditions throughout the survey. This indicates that mainstem flow conditions were not modified to an extent measurable by gages 01170500, 01172010, and 01184000. However, no gage exists between the Vernon Dam and the Turners Falls Dam. It is known that flow modification affects this length of the river. Flow modification within this upper section of the Connecticut River is evidenced by the continued bank erosion within this section. Also, the Turner's Falls power canal diverts water from the natural river channel. At present, minimum instream flows from the base of the Turner's Falls dam to the outfall of the power canal is 200 cfs. The adequacy of this volume of water for the support of aquatic life is currently under debate.

**Figure 2: Streamflow at Three Mainstem Connecticut River Gages**



Streamflow measurements from the furthest downstream gages on the major contributing rivers to the Connecticut River within Massachusetts (Millers River, Deerfield River, Chicopee River, and Westfield River) were also examined as they contribute significant volumes of water to the Connecticut River. These gages were:

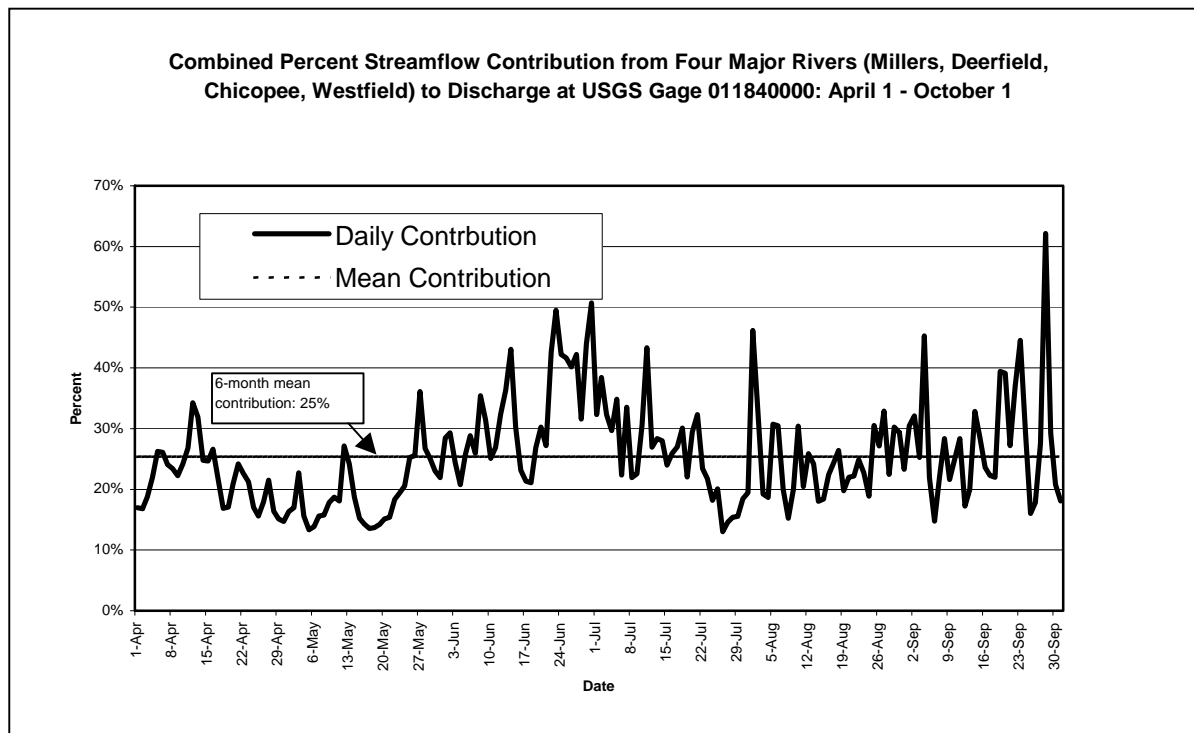
<u>Gage Number</u>	<u>Gage Description</u>
01166500	MILLERS RIVER AT ERVING, MA Drainage Area: 372 mi <sup>2</sup> 7Q10: 46.8 cfs (Wandle 1984)
01170000	DEERFIELD RIVER NEAR WEST DEERFIELD, MA Drainage Area: 557 mi <sup>2</sup> 7Q10: 95.6 cfs (Wandle 1984)
01177000	CHICOPEE RIVER AT INDIAN ORCHARD, MA Drainage Area: 689 mi <sup>2</sup> 7Q10: 128 cfs (Wandle 1984)
01183500	WESTFIELD RIVER NEAR WESTFIELD, MA Drainage Area: 497 mi <sup>2</sup> 7Q10: 77.3 cfs (Wandle 1984)

Discharge from the four major contributing rivers had a great impact on the measured flow at USGS Gage 01184000 (Thompsonville, CT). The combined discharge from these rivers, on average, accounted for 26% of the water in the Connecticut River during the examined period (April 1 – October 1) (Figure 3). Also, on a total of 14-days, from April 1 to October 1, these four major rivers contributed more than 40% of the water flowing past the Thompsonville Gage. Further examination of the discharge data for the studied time period shows that the Millers River average contribution was approximately 4%. The average

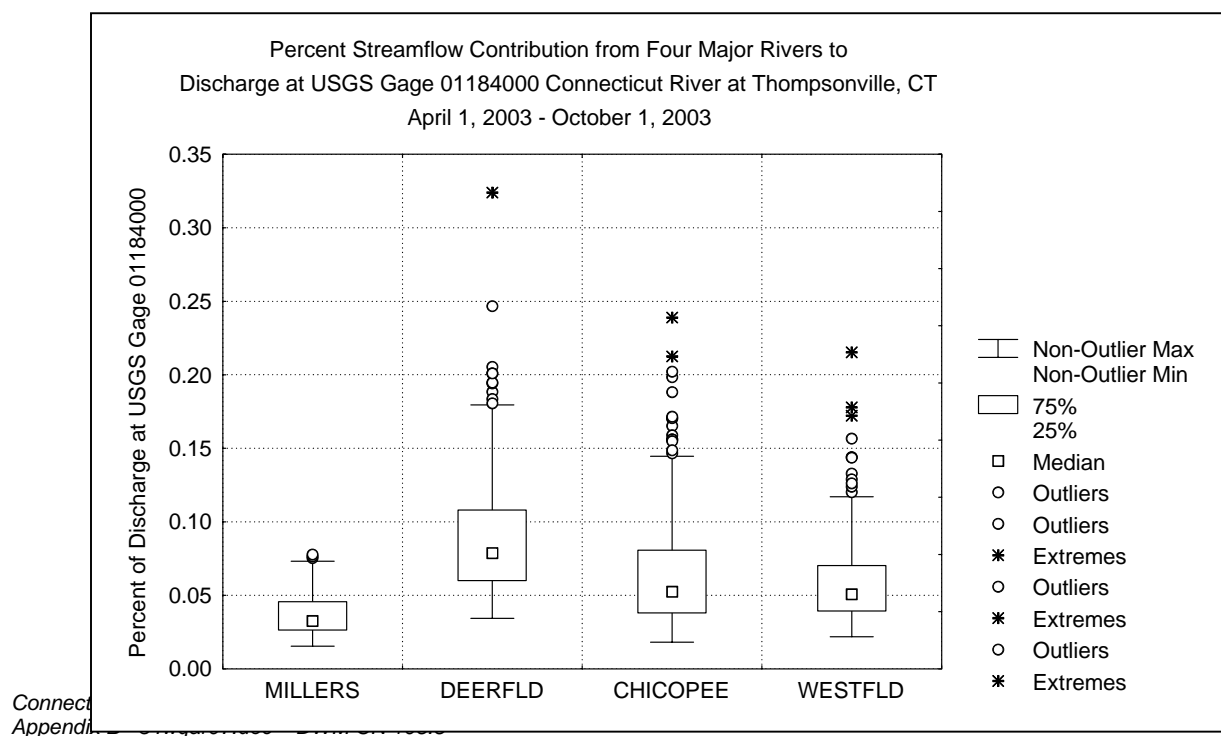
contribution from the Deerfield River was approximately 9%. The average contribution from the Chicopee River was approximately 7%, and the average contribution from the Westfield River was approximately 6% (Figure 4).

Streamflow measurements from the sole Farmington River gage (01185500 - WEST BRANCH FARMINGTON RIVER NEAR NEW BOSTON, MA) located in Massachusetts were not addressed, as the mouth of the Farmington River is in the state of Connecticut, and does not affect the streamflow in the Massachusetts portion of the Connecticut River.

**Figure 3: Combined Percent Streamflow Contribution from Four Major Rivers April 1 to October 1**



**Figure 4: Individual Percent Streamflow Contribution from Four Major Rivers April 1 to October 1**



## RAINFALL MEASUREMENTS

The Massachusetts Department of Conservation and Recreation (MA DCR) manages rainfall measurements from over 100 gauges across the Commonwealth. Measurements taken at three gages, located along the length of the Connecticut River, were used in this examination (Marler 2004 and MA DCR undated). Rainfall data were used to determine if collected water quality samples might be considered “wet-weather” or “dry-weather” samples. The three MA DCR rainfall gauges are:

<u>Gage Number</u>	<u>Gage Description</u>
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GRE203	Greenfield Waste Water Treatment Facility, Greenfield, MA
AMH307	Amherst Waste Water Treatment Facility, Amherst, MA
HOL217	Holyoke Dam, Holyoke, MA

The Greenfield rainfall measurements were very similar to those recorded at Amherst. The total rainfall measured from April 1 to October 1 was 32.05-inches at the Greenfield gauge, and 32.84-inches at the Amherst gauge. The maximum daily precipitation event occurred on September 29<sup>th</sup>, and measured 3.09 inches at the Greenfield gauge. At the Amherst gauge, the maximum daily precipitation event also occurred on September 29<sup>th</sup>, and measured 2.31 inches. Precipitation conditions as measured at the Holyoke gauge were different from the Greenfield gauge and the Amherst gauge. The total rainfall measured at the Holyoke gauge from April 1 to October 1 was 25.78 inches. The maximum daily precipitation event at Holyoke occurred on September 24<sup>th</sup>, and measured 2.9 inches.

The three selected MA DCR rainfall gauges were located near the mainstem of the Connecticut River, and were located in the northern, central, and southern sections of the Connecticut River Watershed in Massachusetts. The water quality monitoring stations were also dispersed throughout the watershed, and each was associated with the most proximal (nearest) rainfall gauge to determine the conditions that prevailed leading up to the time of sampling.

MA DCR rainfall gauge GRE203 (Greenfield) was nearest to the following water quality stations:

CT04	Deerfield River
BB01	Bloody Brook
26A	Sawmill River
CT05	Millers River

MA DCR rainfall gauge AMH307 (Amherst) was associated with the following water quality stations:

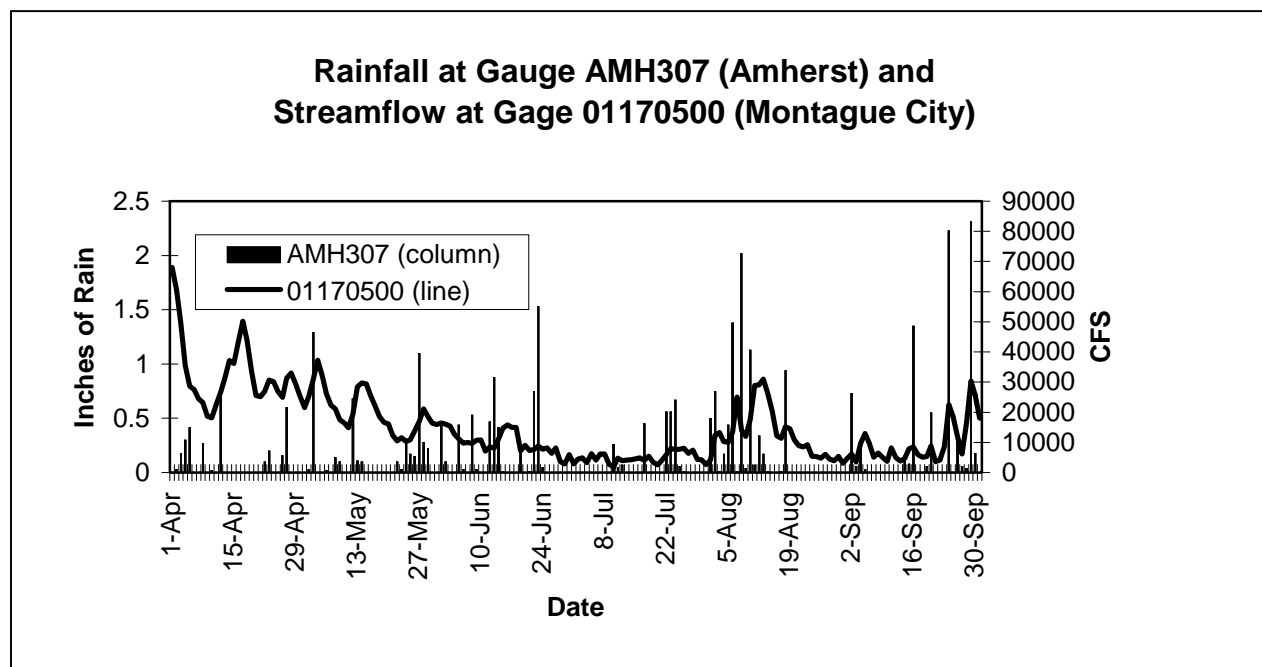
CT06	Connecticut River
02A	Connecticut River
04A	Connecticut River
04C	Connecticut River
05A	Connecticut River
CT00	Connecticut River
28B	Mill River (Northampton)
EBMR01	East Branch Mill River (Northampton)
WBMR01	West Branch Mill River (Northampton)
27B	Fort River
24B	Mill River (Hatfield)
25C	Mill River (Hadley)
CT02	Westfield River
CT03	Chicopee River

MA-DCR rainfall gauge HOL217 (Holyoke) was nearest to the following water quality stations:

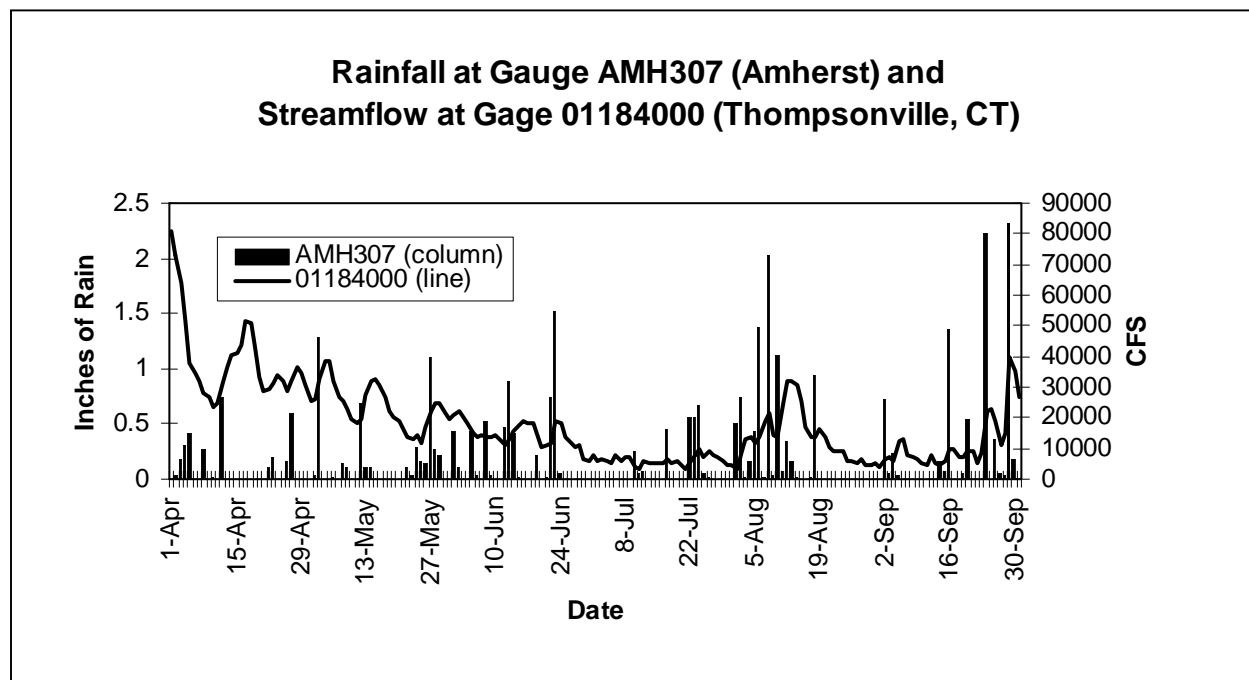
19A	Stony Brook
07A	Bachelor Brook
23A	Weston Brook
06A	Lampson Brook
11A	Manhan River
11C	Manhan River

All mainstem Connecticut River samples were associated with precipitation data from the MA DCR rainfall station AMH307 (Amherst). Although it is the case that mainstem stations CT06 and 02A are closest to the Greenfield rain gauge, and mainstem stations 05A and CT00 are closest to the Holyoke rain gauge, the Amherst rain gauge was used to describe precipitation conditions that potentially affect all mainstem stations. This relationship between all mainstem stations and the Amherst rainfall station (AMH307) was formed in the interest of clarity and uniformity. The streamflow within the Connecticut River in Massachusetts is affected by rainfall within many subwatersheds. As such, a rain gauge located in the most central portion of the Connecticut River Watershed was chosen. Figures 5 and 6 illustrate the relationship between rainfall measurements at AMH307 and discharge measurements at Montague City (01170500) and Thompsonville, CT (01184000). Both the northernmost (USGS gage number 01170500) and southernmost (USGS gage number 01184000) streamflow gages respond similarly when compared to rainfall data from the central location.

**Figure 5: Amherst Rainfall and Streamflow at Montague City**



**Figure 6: Amherst Rainfall and Streamflow at Thompsonville, CT**



The data from the three MA DCR rainfall gauges (Tables 2, 3 and 4) show that some “wet-weather” samples were collected during the sampling season. It is the practice of DWM to define a “wet-weather” sample as one that was collected at a location that received at least 0.5 inches of rainfall within the 72-hours antecedent to sample collection. However, a significant precipitation event (> 0.5 inches) should be accompanied by a noticeable response in instream flow. If the ground is quite dry, then the rain may be absorbed and have no noticeable effect upon instream flow. Also, the impounded conditions encountered within the Connecticut River Watershed may mask the effects of a precipitation event.

<b>Table 2: 2003 precipitation data from MA DCR gauge GRE203 (Greenfield)</b>						
	5-days prior	4-days prior	3-days prior	2-days prior	1-day prior	Sample Date
Date	25-April	26-April	<b>27-April</b>	28-April	29-April	30-April
Rain (Inches)	0	0.06	<b>0.72</b>	0	0	0
Date	30-May	31-May	1-Jun	2-Jun	3-Jun	4-Jun
Rain (Inches)	0.01	0	0.45	0.04	0	0
Date	4-Jul	5-Jul	6-Jul	7-Jul	8-Jul	9-Jul
Rain (Inches)	0	0	0	0	0	0
Date	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	<b>6-Aug</b>
Rain (Inches)	0.48	1.4	0	0.32	0.22	<b>0.75</b>
Date	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep
Rain (Inches)	0.03	0	0	0	0	0
Date	26-Sep	27-Sep	28-Sep	<b>29-Sep</b>	30-Sep	1-Oct
Rain (Inches)	0.26	0.1	0.02	<b>3.09</b>	0.14	0.01

\*Significant rain events (>0.5-inches) in **bold**



<b>Table 3: 2003 precipitation data from MA DCR gauge AMH307 (Amherst)</b>						
	5-days prior	4-days prior	3-days prior	2-days prior	1-day prior	Sample Date
Date	25-April	26-April	<b>27-April</b>	28-April	29-April	30-April
Rain (Inches)	0	0.16	<b>0.6</b>	0	0	0
Date	30-May	31-May	1-Jun	2-Jun	3-Jun	4-Jun
Rain (Inches)	0	0	0.43	0.1	0	0
Date	4-Jul	5-Jul	6-Jul	7-Jul	8-Jul	9-Jul
Rain (Inches)	0	0	0	0	0	0
Date	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	<b>6-Aug</b>
Rain (Inches)	0.5	0.75	0.01	0.17	0.44	<b>1.38</b>
Date	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep
Rain (Inches)	0.03	0	0	0	0	0
Date	26-Sep	27-Sep	28-Sep	<b>29-Sep</b>	30-Sep	1-Oct
Rain (Inches)	0.36	0.06	0.04	<b>2.31</b>	0.18	0

\*Significant rain events (>0.5-inches) in **bold**

<b>Table 4: 2003 precipitation data from MA DCR gauge HOL217 (Holyoke)</b>						
	5-days prior	4-days prior	3-days prior	2-days prior	1-day prior	Sample Date
Date	25-April	26-April	27-April	28-April	29-April	30-April
Rain (Inches)	0	0	0	0	0	0
Date	30-May	31-May	<b>1-Jun</b>	2-Jun	3-Jun	4-Jun
Rain (Inches)	0	0	<b>0.63</b>	0.16	0	0
Date	4-Jul	5-Jul	6-Jul	7-Jul	8-Jul	9-Jul
Rain (Inches)	0	0	0	0	0	0
Date	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug
Rain (Inches)	0	0	0	0.19	0	0
Date	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep
Rain (Inches)	0.02	0	0	0	0	0
Date	26-Sep	27-Sep	<b>28-Sep</b>	<b>29-Sep</b>	30-Sep	1-Oct
Rain (Inches)	0	0	<b>0.6</b>	<b>2.23</b>	0.16	0.06

\*Significant rain events (>0.5-inches) in **bold**

The samples collected from the stations on the dates listed in Table 5 are considered to be representative of wet-weather conditions.

<b>Table 5: 2003 Wet-weather Sample Determination</b>	
Sample Collection Date	Water Quality Station
April 30	CT04, BB01, 26A, CT05, CT06, 02A, 04A, 04C, 05A, CT00, 28B, EMBR01, WBMRO1, 07B, 24B, 25C, CT02, CT03
June 4	19A, 07A, 23A, 06A, 11A, 11C
July 9	<b>No</b> samples considered to be "wet-weather" samples
August 6	CT04, BB01, 26A, CT05, CT06, 02A, 04A, 04C, 05A, CT00, 28B, EMBR01, WBMRO1, 07B, 24B, 25C, <b>27B</b> , CT02, CT03
September 10	<b>No</b> samples considered to be "wet-weather" samples
October 1	<b>All</b> samples considered to be "wet-weather" samples

## **Pertinent Observations Regarding Stations and Conditions**

### **Station CT02: Westfield River, Route 147 bridge, Agawam/West Springfield**

This station was located on the downstream side of the route 147 bridge – 2.25 miles upstream from the confluence with the Connecticut River. At this point, the Westfield River defines the border between the town of Agawam and the city of West Springfield. The station was accessed by parking in the Rocky's hardware parking lot and walking to the sidewalk on the downstream side of the route 147 bridge. Water samples were collected via "Bottle Basket Sampling Device" (see CN001.4. *MADEP/DWM Bottle Basket Sampling Device* (Chase 2003b) because there was no reasonable method to access the river at this site. These data were used to assess the nutrient loading from the Westfield River to the Connecticut River.

Due to the height of the bridge, visual observations of proximal water and habitat conditions were limited. However, the water was usually clear (and without color) except on the two sampling occasions (August 6<sup>th</sup> and October 1<sup>st</sup>) when high flows were accompanied by an increase in turbidity.

### **Station CT04: Deerfield River, Route 5/10 bridge, Deerfield/Greenfield**

This station was located between the downstream side of the Route 5 / 10 Bridge and the upstream side of the railroad bridge (approximately 1 mile upstream from the mouth of the river). Parking under the railroad bridge and walking down to the river along the southern bank accessed the station. Water samples were collected by wading into the river from the right bank. Data from this site will be used to assess the nutrient loading to the Connecticut River.

The substrate at this location was a mix of sand and gravel. These finer sediments are prone to erosion, and slumping and undercut banks were observed during station visits. The water was usually clear (and without color) except on the two sampling occasions (August 6<sup>th</sup> and October 1<sup>st</sup>) when high flows were accompanied by an increase in turbidity, and the water had a yellow / tan color. This was evidence of suspended sediment. The nearby, upstream (river-left) golf course is frequently flooded, as is the nearby, upstream (river-right) field.

### **Station CT06: Connecticut River, Route 10 bridge, Northfield**

This station was located at the Route 10 bridge in Northfield. It was the most upstream mainstem water quality station during the 2003 survey (3.5 river miles from the Vermont / New Hampshire border). Data collected from this station was used to assess water quality conditions as the river entered the state. Survey vehicles were parked in the Bennett Meadow Conservation Area parking lot. From there, survey crews walked to the center of the bridge, and collected samples via "Bottle Basket Sampling Device" from the downstream side of the bridge.

The height of the bridge made habitat observations difficult. The water was most often colored brown, and the bottom was most often unobservable due to depth and lack of water clarity. The riverbanks are prone to erosion in this reach. The soft sand banks may become inundated when the Turner's Falls dam holds back water. On occasion, this water has been released faster than it can drain from the sandy soils. These saturated soils become unstable, and have often slumped into the river. Studies and remediation of this condition continue through the hands of both government and non-government entities. Bank erosion mitigation projects have included the application of used tires (in a variety of patterns), rip-rap, re-grading, re-vegetation, and other bio-engineering techniques (Simons *et al.* 1978).

### **Station 02A: Connecticut River, downstream of Fourmile Brook confluence, Northfield and east of Pisgah Mountain Road, Gill**

This station was located approximately 5.5-river miles downstream of station CT06, at the Northfield Mountain Pumped Storage picnic area in Northfield. Between the two stations, there are inputs from the

Town of Northfield, Northfield Mount Hermon Preparatory Academy, and riparian agricultural activities. Flow modification affects this site due to the operations of the Vernon Dam (VT), the Turner's Falls Dam, and the Northfield Mountain Pumped Storage Facility. Survey vehicles were parked near, or within, the picnic parking area. Samples were collected by launching a canoe (with permission from Northfield Mountain) from the boat dock near the picnic area. Due to high water, and a concern for safety, only three sets of samples (July 9, August 6, September 10) were collected.

Although the water was clear on two of the three sampling occasions, the river bottom (at the thalweg) was unobservable from a canoe (due to the depth). The "feel" of the anchor on the bottom led the survey crews to believe that the substrates were a combination of coarse gravel and cobble.

#### **Station 04A: Connecticut River, Route 116, Deerfield / Sunderland**

This station was located 9.3 river miles downstream of the confluence with the Deerfield River, and it is assumed that the Deerfield and the Connecticut rivers are fully mixed by the time their waters pass this station. This station was downstream from the discharges from the City of Greenfield, the Bitzer State Fish Hatchery, the Turner's Falls Dam, and the industrialized power canal at Turner's Falls.

Samples were collected from this station using both the "Bottle Basket Sampling Device" and via canoe. The first two sampling events (April 30, June 4) employed the "Bottle Basket Sampling Device" from the Route 116 Bridge. However, the high volume of traffic on the bridge made this an unsafe method of sample collection. The subsequent three surveys utilized a canoe to collect the samples. Survey vehicles were parked at the boat launch on the Sunderland side of the river, and the canoe was paddled out into the river. The power-lines that cross the Connecticut River were used as a guide. The canoe was positioned under these power-lines at the time of sample collection.

The river was quite shallow, and wide, at this station. The cobble and boulder substrates were usually observable during the daytime surveys. Submerged aquatic plants were also observed during two of the surveys, but their density was rated as "sparse". The clarity of the water was most often noted as being "slightly turbid" with a brownish color. Although the bank material is quite comparable to conditions found upstream of the Turner's Falls Dam (Stations CT06 and 02A), this station was not affected by erosion as observed at the upstream stations.

#### **Station 04C: Connecticut River, upstream of the confluence of the Mill River near the Oxbow, Northampton/Hadley**

Station 04C was located 0.45 miles upstream from the state boat launch located at the Oxbow formed at the confluence of the Manhan and Connecticut rivers. The station was accessed by parking at the state boat launch and launching a canoe into the Oxbow. Survey crews then paddled the canoe 0.45 miles upstream to a point marked by the end of power-lines, a dirt farm road, and the start of a forested riparian buffer on the river-left bank. This station was sampled on three occasions (July 9<sup>th</sup>, August 6<sup>th</sup>, and September 10<sup>th</sup>). Spring high-flows made sampling unsafe on April 30<sup>th</sup> and June 4<sup>th</sup>. A large rain event (September 29<sup>th</sup>) also made sampling by canoe unsafe on the October 1<sup>st</sup> sampling collection date.

This reach of the Connecticut River is heavily used for boat recreation, as well as for recreational fishing. The water, most often, was slightly turbid, with a brown color. The proximal upstream land-use is still primarily agricultural.

#### **Station 05A: Connecticut River, Route 90, West Springfield/Chicopee**

This station was located approximately 500 feet downstream of the Route 90 (Mass Turnpike) bridge that connects Chicopee and West Springfield. This station was accessed by parking at the state boat launch (Medina Street, Chicopee) and launching a canoe into the Connecticut River. Samples were collected underneath the power-lines that cross the river below the Route 90 Bridge. This station was located approximately 5.4 river miles downstream from the Holyoke Dam, immediately upstream of the Chicopee

WWTF outfall, and 0.4-river miles upstream from the mouth of the Chicopee River. There was no sidewalk on the Route 90 Bridge, and flows were too high to put in a canoe (from the boat launch) on all but three sampling occasions. Sampling was completed on July 9<sup>th</sup>, August 6<sup>th</sup>, and September 10<sup>th</sup>.

Prominent upstream features included the urban areas of Holyoke, North Chicopee, and South Hadley Falls. The banks were stable, with no obvious signs of erosion. The substrate was primarily sand, with some large boulders in the vicinity of the bridge and boat ramp.

**Station CT00: Connecticut River at USGS Gage 01184000, downstream of Route 190, Suffield/Enfield, CT**

This station was located at the USGS Gage (01184000) on the river-right bank of the Connecticut River and approximately 100 meters upstream of the Windsor Locks Canal. Boat access at this station was not possible. As such, samples were collected from the river-right bank.

This was the furthest downstream mainstem Connecticut River station, and was used to document water quality conditions as they leave Massachusetts. The water was clear for the majority of the six sampling events. There were signs of erosion on the steep banks.

**Station 19A: Stony Brook, College Street (Route 116) upstream of confluence of Leaping Well Brook, South Hadley**

The water at this station comes from a 19.6 mi<sup>2</sup> drainage area. It flows through both residential and agricultural landuses, and then through the town of South Hadley. The proximity of the stream to Route 116 allows for little riparian buffering, or canopy cover; opening this stream to potential NPS impacts. Also, Stony Brook flows under many old commercial buildings. This station was accessed by parking in the Chap de Laine's furniture store parking lot (with permission), and walking to the stream. The samples were collected, by wading, immediately upstream of the Route 116 bridge crossing. Station 19A is 2.5 miles from the confluence with the Connecticut River. The water color was most often dark tan, and the clarity was most often highly cloudy.

**Station 07A: Bachelor Brook, Route 47 (Hadley Street), South Hadley**

Bachelor Brook runs along the southern foot of the Holyoke Range, from the outlet of Forge Pond, Granby to the Connecticut River, South Hadley. This station had a 31mi<sup>2</sup> drainage area. Many small farms, wetlands, and residences exist within the proximal upstream watershed. Bachelor Brook is not a high-gradient stream. The stream meanders through most of its course to the Connecticut River. Station 07A is 1 mile upstream of the confluence with the Connecticut River.

This station was accessed by parking along the side of Route 47, and walking to the Route 47 bridge. Samples were collected from the upstream, river-left bank using a sample collection pole. The water always appeared colored (either brown or tan), and usually was turbid. The substrates were primarily sand and mud.

**Station 23A: Weston Brook, Rural Street, Belchertown**

This station has a 3.7 mi<sup>2</sup> contributing drainage area. It has received, in the past, discharges of un-ionized ammonia from the Belchertown WWTP (1.86 miles upstream of this station on Lampson Brook, and 12-miles from the confluence with the Connecticut River)(Kennedy and Weinstein 2000). The town of Belchertown has upgraded their WWTP within the past five years. Data from this station will be used to determine the effectiveness of the remediation techniques.

Weston Brook is a very small stream with low gradient. The majority of the upstream watershed is dominated by Lampson Brook. This station was accessed by parking along Rural Street and walking to

the upstream side of the Rural Street bridge. Due to the small width (and depth) of this stream, samples were collected by wading into the center of the stream. The substrates were primarily coarse gravel and sand. The immediate riparian zone was dominated by residential landuse. The water was clear on all but the final sample collection (October 1), when the water was slightly turbid. This may be a result of the heavy rain on September 29<sup>th</sup>. The water color was most often brown.

**Station 06A: Lampson Brook, George Hannum Street, approximately 50 feet downstream of Belchertown WWTP discharge, Belchertown**

This station has a 1.8 mi<sup>2</sup> contributing drainage area. Lampson Brook is a tributary to Weston Brook (Station 23A). Lampson Brook is the receiving water for the Belchertown WWTP outfall. The Lampson Brook station is located immediately below the Belchertown WWTP (and 0.86-miles upstream of the confluence with Weston Brook). The WWTP, in 2001, was retrofitted to mitigate un-ionized ammonia discharges (Kennedy and Weinstein 2000).

Lampson Brook, at this station 14-miles upstream of the Connecticut River, was quite small. It was possible to straddle the stream during all surveys. This station was accessed approximately 100 feet downstream from the outfall of the final settling pond associated with the Belchertown WWTF. Here, the stream enters a wetland area with very little canopy coverage. The substrates are dominated by the mud and muck associated with wetlands. Water clarity and color were like those observed at Weston Brook (Station 23A). The water was clear on all but the final sample collection (October 1), when the water was slightly turbid. The water color was most often brown.

**Station 11A: Manhan River, Loudville Road, Easthampton**

This station has a 58 mi<sup>2</sup> contributing drainage area, and is 5.7 miles upstream from the Connecticut River. Station 11A was located upstream of the most urbanized portion of Easthampton. A downstream site (Station 11C) was used to compare conditions with the upstream site.

The Manhan River, at this station, is a low-gradient stream. It meanders through an area of pasture and residential landuse. This station was accessed by parking along the side of Loudville Road, and walking to the sample collection point, approximately 100-feet upstream of the Loudville Road bridge. The substrates were primarily sand, and the banks showed some signs of cut-bank erosion. The water was clear on all sampling occasions except August 6<sup>th</sup> and October 1<sup>st</sup>. At these times, the water was slightly turbid and murky.

**Station 11C: Manhan River, Fort Hill Road, Easthampton**

This station is the furthest downstream accessible location on the Manhan River, and is 0.86 miles from the confluence with the Connecticut River. The station has a drainage area of 84 mi<sup>2</sup>. The Manhan River flows through several mills in Easthampton. Between station 11B and this station (11C), the Manhan River receives the inflow from Lower Mill Pond. This pond, fed by Broad Brook, Rubber Thread Pond, and Nashawannuck Pond, receives the majority of the potential industrial effluent. This station is also 0.75 miles downstream of the Easthampton WWTP.

This station was accessed by parking along the side of Fort Hill Street and walking to the upstream side of the Fort Hill Road bridge. Samples were collected by using the "Bottle Basket Sampling Device". The water color was almost always brown (except during the April and June samplings). There were signs of erosion in the sandy / muddy banks. It is assumed that the substrates are primarily comprised of sand and mud, but the bottom was unobservable due to the depth (and turbidity) of the water.

**Station 28B: Mill River, approximately 1 mile downstream of Clement Street (location of USGS gage 01171500 prior to October 2002), Northampton**

Station 28B was the furthest downstream of three water quality stations in the Mill River (Northampton) Watershed. Station 28B is 3.6 miles upstream from the Connecticut River. The drainage area upstream of this location (including both East and West Branches) is 54 mi<sup>2</sup>. This station was located at the old USGS gage house near Smith College. The Mill River flows through historically industrial and currently dense residential landuse types before it reaches this station.

This station was accessed by parking in the lot just west of the community gardens (Burts Pit Road). Survey teams walked down the park-trail to the USGS gage house. Samples were collected by wading into the river from the river-right bank. The substrates were primarily large cobble and boulder. The water was often slightly turbid with a brown color.

**Station EBMR01: East Branch Mill River, south of East Main Street, approximately 200 feet from confluence with West Branch Mill River, Williamsburg**

Station EBMR01 is 10.7 miles upstream of the Connecticut River. Station EBMR01 was sampled in concert with Stations 28B and WBMR01, as they are all within the Mill River (Northampton) Watershed. The data from all these stations can describe the Mill River – Northampton watershed as a whole. The upstream drainage area is 9.5 mi<sup>2</sup>. Although there are nearby residences in the immediate upstream watershed, the watershed was primarily forested. This station was accessed by parking at the end of Mill Street (dead end) and walking to the stream. The substrates were primarily cobble at this station. The instream habitat conditions looked optimal for the support of aquatic life. The water clarity was always clear at this station. The water color was clear and blue on all but the August 6<sup>th</sup> sampling event (when it was light tan).

**Station WBMR01: West Branch Mill River, Mill Street, Williamsburg**

Station WBMR01 is 10.7 miles upstream of the Connecticut River. Data from this station is best associated with data from stations EBMR01 and 28B. Together, they provide a description of water quality conditions in the Mill River (Northampton) and its tributaries. The drainage area upstream of this location is approximately 12.75 mi<sup>2</sup>.

This station was accessed by parking at the end of Mill Street (dead end) and walking to the stream. Substrate conditions in the West Branch of the Mill River were similar to those observed in the East Branch of the Mill River. The substrates were primarily cobble. However, the West Branch appears to have been straightened. This has resulted in an increase in velocity, and slightly larger substrates than occurred in the East Branch. The water clarity and color were also similar to the conditions observed in the East Branch.

**Station 27B: Fort River, Route 47, Hadley**

Station 27B was located approximately 0.7 miles upstream of the confluence with the Connecticut River. Approximately 56.4 mi<sup>2</sup> of drainage area lie upstream of this location. The majority of the river is low-gradient, with a relatively sandy substrate. Much of the water passing Station 27B comes from Lawrence Swamp (a high-density area of ground water supply). The river meanders heavily on its way to the Connecticut River. At this station, the Fort River has received runoff from the Town of Amherst, the Mill Valley Golf Course, and agricultural runoff from several farms. This station was accessed by parking along Route 47, and walking to the upstream side of the bridge. Samples were collected from the river-left bank, at a minor constriction in the river created by the remains of an industrial-era dam. The water was brown and turbid for the majority of the sampling events (except during the June sampling event – when it was clear).

#### **Station 24B: Mill River, Maple Street, Hatfield**

This station has a contributing drainage area of 48.4 mi<sup>2</sup>, and lies 2.5 miles upstream of its confluence with the Connecticut River. Aside from its high-gradient headwaters, the Mill River takes a low-gradient and meandering course through the farms of Hatfield. In addition to potential NPS agricultural runoff, there are potential impacts from Route 91, a fertilizer company (LESCO), industries located in South Deerfield (via Bloody Brook), and water withdrawals by the towns of Northampton and South Deerfield.

This station was accessed by parking at the pumping station, and walking to the sample collection point which was located approximately 100-feet upstream of the Maple Street bridge, on the river-left bank. Substrates were mostly sand and gravel at this station. The water color was most often brown, and the clarity was most often slightly turbid (except during the April sampling event – when it was clear).

#### **Station BB01: Bloody Brook, Whately Road, Deerfield**

Bloody Brook begins its course in the Pocumtuck Range (Deerfield). It quickly loses its high-gradient nature as it enters the Connecticut River valley floor. It flows through farms, residential areas, and then through the Town of South Deerfield. After crossing under Route 91, it crosses Whately Road at Station BB01.

This station (21 miles upstream of the Connecticut River) was accessed by parking on the side of Whately Road and walking to the upstream side of the Whately Road bridge. Samples were collected immediately upstream from the bridge. Bloody Brook, at this station, is very low-gradient. The substrates are mostly mud and sand. The water velocity is also very low. The water was always turbid and brown.

#### **Station 25C: Mill River, Mill River Lane, Hadley**

The drainage area upstream of this station is 26.8 mi<sup>2</sup>. This station lies 2.9 miles upstream from the confluence with the Connecticut River. The headwaters of the Mill River (Hadley) drain Atkins Reservoir (a drinking water supply to the Town of Amherst) and Factory Hollow Pond (aka Puffer's Pond – a heavily used recreational area). Cushman Brook emerges from this pond via an overflow dam. It receives the runoff from residential and commercial land use in North Amherst. The stream crosses Route 116 and joins Eastman Brook (which receives the discharges from Bioshelters Fish Hatchery and the Cronin National Fish Hatchery) where it becomes "Mill River (Hadley)". The stream then turns south and parallels Route 116. Here, it receives runoff from several farms, and the majority of runoff from the UMass / Amherst Campus.

This station was accessed by parking at the end of Mill Site Road, where the bridge is "out". Survey crews then walked to the river-left bridge abutment and collected samples from the river-left bank. The Mill River (Hadley), at this location, is low gradient, and the substrates were primarily mud and sand. The stream meanders quite a bit, except near Route 116, where it has been straightened. The water was usually slightly turbid and brown during the survey.

#### **Station 26A: Sawmill River, South Ferry Road, Montague**

The Sawmill River drains 31 mi<sup>2</sup>, from its origin at the outfall of Lake Wyola to its confluence with the Connecticut River. Station 26A was 2.5 miles upstream from the confluence with the Connecticut River. The Sawmill River surrenders much of its gradient by the time it reaches the sampling location, where it begins to meander through the softer substrates that make up the Connecticut River valley floor. At this sampling location, the river receives runoff from the town of Montague, as well as potential agricultural inputs.

This station was accessed by parking along the side of South Ferry Road and walking to the upstream side of the South Ferry Road bridge. Samples were collected approximately 10 feet upstream of the bridge. The substrates were primarily gravel, and some cobble. Pasture and some residences dominated

the immediate upstream landuse. On all but two occasions (August 6<sup>th</sup> and October 1<sup>st</sup>), the water was clear and had no color. On August 6<sup>th</sup> and October 1<sup>st</sup> the water was slightly turbid and light tan in color in response to a rain event.

#### **Station CT05: Millers River, Route 63 Bridge, Erving / Montague**

This station was accessed by parking in the Renovator's Supply parking lot (with permission), and walking to the river-right, downstream side of the Route 63 Bridge (1.86 miles upstream from the confluence with the Connecticut River. Samples were collected from this bank. The Millers River substrates at this location are dominated by cobble and boulder. The water was clear, with a light tan color, on most of the sampling events. However, slight turbidity was noted on the August 6<sup>th</sup> and October 1<sup>st</sup> sampling occasions. This is most likely due to recent rainfall.

#### **Station CT03: Chicopee River, Route 116 Bridge, Chicopee**

This station was accessed by parking along the side of Granby Road, and walking to a point on the river-right bank of the river, approximately 250-feet upstream of the Route 116 bridge (0.9 miles upstream of the confluence with the Connecticut River. Samples were collected from this river-right bank. The water was most often clear, but with a brown or tan color.

#### **Water Quality Data**

Raw data files, field sheets, lab reports and chain of custody (COC) records are stored in open files at the DWM in Worcester. All MassDEP DWM water quality data are managed and maintained in the *Water Quality Data Access Database*. Data exports for publishing are provided by DWM's database manager. Data Tables 1 and 2 are **QC Status 4** ("Final") data exports for the Connecticut Watershed. This level of data reflects project-level review by appropriate staff for reasonableness, completeness and acceptability. These data can be freely used and cited in documents without caution or caveat.

Water quality data for multi-probe parameters (dissolved oxygen, percent dissolved oxygen saturation, pH, conductivity, water temperature and total dissolved solids) are in Data Table 1, and for nutrients (total phosphorus, nitrate-nitrite, ammonia), fecal coliform and *E. coli* bacteria are in Data Table 2.

Data validation procedures are described in *Data Validation Report for Year 2003 Project Data* (Chase et al 2005b). Validation of data from discrete water samples is based on acceptable relative percent differences for field duplicates and the lack of contamination (i.e. less than method detection limits) for ambient field blanks. Quality control sample data are provided in Appendices 1 and 2. Definitions of symbols and qualifiers used in DWM data tables are provided in Appendix 3.



**Data Table 1: Connecticut River Watershed Survey 2003 Multiprobe Data - Temperature, pH, Conductivity, Total Dissolved Solids, Dissolved Oxygen, % Saturation**

(Note: Symbols and Qualifiers Used for DWM Data can be found in Appendix 3.)

**Connecticut, (2003) (QC Status: 4) Exported: 10/4/2005 11:24:21 AM**

**CONNECTICUT RIVER (SARIS: 3417100)**

**Unique\_ID: W0478 Station: CT06, Mile Point: 64.425**

Description: [Route 10 bridge, Northfield.]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0130	10:48	0.4	8.9	7.1 c	92.5	59.2	12.1	106
06/02/03	34-0180	23:15	0.6 i	16.6	7.2	122	77.9	9.4	99
08/05/03	34-0348	00:01	0.2 i	23.9	7.2 c	121	77.2	7.7 u	92 u
08/06/03	34-0406	07:48	0.4 i	23.9	7.0 c	120	76.8	7.0	84
09/09/03	34-0453	00:24	0.9 i	21.5	7.3 ic	153	98.0	8.5	97
10/01/03	34-0518	08:15	0.3 i	15.8	7.2	112 u	71.9 u	9.4 u	95 u

**CONNECTICUT RIVER (SARIS: 3417100)**

**Unique\_ID: W1044 Station: 02A, Mile Point: 58.772**

Description: [downstream of Fourmile Brook confluence, Northfield and east of Pisgah Mountain Road, Gill]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
07/08/03	34-0246	00:39	1.1	27.7	7.6	139	90.0	8.3 i	105 i
07/09/03	34-0304	09:07	1.0	27.2	7.5	138	89.0	7.8 i	99 i
08/05/03	34-0356	00:10	1.0	23.7	7.2 uc	119	78.0	7.6	90
08/06/03	34-0414	07:57	0.7 u	23.7	7.3 c	108	70.0	7.5	88
09/09/03	34-0461	00:08	1.0	21.7	7.5 uc	152	99.0	9.3	106

**CONNECTICUT RIVER (SARIS: 3417100)**

**Unique\_ID: W1045 Station: 04A, Mile Point: 40.229**

Description: [Route 116, Deerfield/Sunderland]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0132	12:10	0.3	9.0	7.0 cu	91.9	58.8	12.1	106
06/03/03	34-0189	00:31	0.2 i	15.9	7.0	116	74.1	9.5	98
07/08/03	34-0188	01:49	1.4	26.6	7.4 u	135	88.0	7.6 i	95 i
07/09/03	34-0305	10:23	1.0	26.3	7.4	136	88.0	7.3 i	91 i
08/05/03	34-0357	01:12	0.6	24.4	7.4 c	121	78.0	7.8	93
08/06/03	34-0415	09:53	0.6 u	23.6	7.4 uc	118	77.0	8.0	94
09/09/03	34-0462	01:05	1.1 u	21.4	7.4 uc	141	91.0	8.7	98

**CONNECTICUT RIVER (SARIS: 3417100)**

**Unique\_ID: W1046 Station: 04C, Mile Point: 22.403**

Description: [upstream of the confluence of the Mill River, near the Oxbow, Northampton/Hadley]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
07/08/03	34-0248	02:59	2.3 u	27.2	7.6	138	89.0	8.2 i	103 i
07/09/03	34-0306	11:29	2.3	27.0	7.8	136	88.0	8.8 i	111 i
08/05/03	34-0358	02:10	1.1	24.9	7.5 c	128	83.0	7.8	94
08/06/03	34-0416	10:42	0.8 u	24.0	7.4 uc	117	76.0	7.9 u	94 u
09/09/03	34-0463	02:02	1.0 u	21.7	7.5 c	141	92.0	8.9	102

**CONNECTICUT RIVER (SARIS: 3417100)**

**Unique\_ID: W1047 Station: 05A, Mile Point: 9.947**

Description: [Route 90, West Springfield/Chicopee]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
07/08/03	34-0249	04:02	1.2 u	27.5	7.4	143	93.0	7.5 i	95 i
07/09/03	34-0307	12:29	1.1	27.3	7.6	139	90.0	8.3 i	105 i
08/05/03	34-0359	03:11	0.9	25.0	7.4 c	139	90.0	7.4	90
08/06/03	34-0417	11:37	0.8 u	25.1	7.4 c	128	83.0	7.7 u	93 u
09/09/03	34-0464	02:59	0.9 u	22.2	7.4 c	149	97.0	8.8	101

**CONNECTICUT RIVER (SARIS: 3417100)****Unique\_ID: W1395 Station: CT00, Mile Point: -2.994**Description: [At the USGS flow gaging station #01184000 downstream of Route 190, Suffield/Enfield Connecticut  
(The point in Arcview is as close as the MA state quad image allows, actual point is further downstream.)]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0139	08:26	0.5	10.4	7.0 c	98.3	62.9	11.1	101
06/02/03	34-0172	23:37	0.5	16.1	7.0	114	72.9	9.2	95
07/08/03	34-0230	00:33	0.5	27.9	7.4	162	105	8.0 i	101 i
08/05/03	34-0340	00:11	0.4	24.7	7.2 uc	159	103	7.3	87
08/06/03	34-0398	08:00	0.5	24.6	7.3 uc	151	98.0	7.3	88
09/09/03	34-0445	00:25	0.7	22.4	7.5 u	157	102	9.0	104
10/01/03	34-0510	08:08	0.9	15.7	7.1 u	108	70.0	9.6	97

**STONY BROOK (SARIS: 3417925)****Unique\_ID: W1053 Station: 19A, Mile Point: 2.277**

Description: [College Street (Route 116) upstream of confluence of Leaping Well Brook, South Hadley]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0142	11:21	0.9	16.2	7.4 c	151	97.0	9.7	101
06/03/03	34-0175	01:46	0.5	16.1	7.5	149	95.2	9.3	97
07/08/03	34-0240	03:15	0.9	25.9	7.7 u	180	117	8.0 i	99 i
08/05/03	34-0343	02:10	0.5 u	23.7	7.8 c	176	115	8.2	97
08/06/03	34-0401	09:59	## m	## m	## m	## m	## m	## m	## m
09/09/03	34-0448	02:19	0.7	19.8	7.6 u	173	112	9.0	99
10/01/03	34-0513	10:33	1.6	13.7	7.5 u	121	79.0	10.7	103

**BACHELOR BROOK (SARIS: 3418000)****Unique\_ID: W1052 Station: 07A, Mile Point: 0.916**

Description: [Route 47 (Hadley Street), South Hadley]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0143	11:52	1.0	14.6	7.4 c	164	105	10.2	102
06/03/03	34-0176	02:18	0.6	16.1	7.3	151	97.0	9.0	93
07/08/03	34-0241	03:43	0.8	25.2	7.5 u	158	103	7.4 i	90 i
08/05/03	34-0344	02:31	0.8	23.3	7.4 uc	209	136	7.2	85
08/06/03	34-0402	10:27	0.6	23.0	7.5 c	195	127	8.0	93
09/09/03	34-0449	02:43	0.9	18.9	7.5 u	182	118	8.2 u	89 u
10/01/03	34-0514	10:52	1.4	13.7	7.3 u	129	84.0	10.3	99

**WESTON BROOK (SARIS: 3418100)****Unique\_ID: W1054 Station: 23A, Mile Point: 0.441**

Description: [Rural Street, Belchertown]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0140	10:12	0.1 i	12.1	7.1 c	281	180	10.2	97
06/03/03	34-0173	00:40	0.1 i	13.6	7.0	235	151	8.7 u	85 u
07/08/03	34-0238	02:15	0.3	20.7	7.3	329	214	7.8 i	87 i
08/05/03	34-0341	01:10	0.2	20.5	7.3 uc	283	184	7.7	86
08/06/03	34-0399	09:00	0.2	20.5	7.2 c	252	164	7.7	86
09/09/03	34-0446	01:27	0.4 i	15.5	7.4	380	247	9.2	93
10/01/03	34-0511	09:37	0.4	10.8	7.0	224	145	9.7 u	88 u

**LAMPSON BROOK (SARIS: 3418125)****Unique\_ID: W1055 Station: 06A, Mile Point: 0.907**

Description: [George Hannum Street, approximately 50 feet downstream of Belchertown WWTP (MA0102148) discharge, Belchertown]

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25°C	TDS	DO	SAT
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/L)	(mg/L)	(%)
04/29/03	34-0141	10:41	0.2	13.2	7.1 c	327	209	10.5	102
06/03/03	34-0174	01:04	0.2	13.0	7.2 u	415 u	265 u	9.4 u	92 u
07/08/03	34-0239	02:37	0.3	19.9	7.6 u	500	325	8.9 i	98 i
08/05/03	34-0342	01:34	0.3	20.7	7.6 uc	434 u	282 u	8.4	94
08/06/03	34-0400	09:24	0.2	20.2	7.5 c	295	192	8.5	94
09/09/03	34-0447	01:47	0.4 i	17.7	7.7	554 u	360 u	9.2	97
10/01/03	34-0512	09:59	0.5	12.5 u	7.4	301 u	196 u	10.2	96

**MANHAN RIVER (SARIS: 3418175)****Unique\_ID: W1064 Station: 11A, Mile Point: 5.633**

Description: [Loudville Road, Easthampton]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0145	14:33	0.6	13.0	6.9 c	96.8	62.0	10.1	97
06/03/03	34-0179	03:26	1.2	14.5	7.0 u	110	70.3	9.2 u	92 u
07/08/03	34-0244	05:13	0.8	20.8	7.1 u	140	91.0	8.0 iu	90 iu
08/05/03	34-0347	04:13	0.7	20.3	7.1 uc	117	76.0	7.8	87
08/06/03	34-0405	12:06	0.5	20.6	7.1 uc	120	78.0	8.3	92
09/09/03	34-0452	04:10	0.7	15.7	7.2 u	154	100	8.9	89
10/01/03	34-0517	12:14	0.7	13.0	6.9 u	96.0	62.0	10.0 u	95 u

**MANHAN RIVER (SARIS: 3418175)****Unique\_ID: W1065 Station: 11C, Mile Point: 0.842**

Description: [Fort Hill Road, Easthampton]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0146	13:48	2.0	13.2	7.1 cu	131	83.5	10.2	98
06/03/03	34-0178	03:50	0.3	13.8	6.8 c	84.8	54.3	9.1	90
07/08/03	34-0243	04:52	0.4	22.8	7.2 u	175	114	7.4 i	86 i
08/05/03	34-0346	03:38	0.4	21.6	7.3 c	144	94.0	8.0	91
08/06/03	34-0404	11:32	0.4	21.5	7.3 c	153	99.0	8.3	94
09/09/03	34-0451	03:44	0.7 u	17.4	7.3	186	121	8.4	88
10/01/03	34-0516	11:50	1.7 u	13.5	7.0 u	113	74.0	10.1	97

**MILL RIVER (SARIS: 3418825)****Unique\_ID: W1059 Station: 28B, Mile Point: 0.611**

Description: [approximately 1 mile downstream of Clement Street (location of USGS gage 01171500 prior to October 2002), Northampton]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0138	16:17	0.6	13.2	8.2 c	98.1	62.7	10.8 u	105 u
06/03/03	34-0187	03:38	## i	13.6	6.8 c	101	64.5	10.0 u	99 u
08/05/03	34-0355	04:08	## i	22.0	7.1 c	115	73.5	8.1	94
08/06/03	34-0413	12:51	0.2 i	22.1	7.4 c	97.9	62.7	8.6	100
09/09/03	34-0460	04:01	## i	16.7	## i	150	96.0	9.0	94
10/01/03	34-0525	13:27	0.2 i	12.4	6.9	92.4 u	59.2 u	10.3 u	97 u

**EAST BRANCH MILL RIVER (SARIS: 3419150)****Unique\_ID: W1056 Station: EBMRO1, Mile Point: 0.038**

Description: [south of East Main Street approximately 200 feet from confluence with West Branch Mill River, Williamsburg]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0137	15:22	0.7	11.4	7.0 c	57.3	36.7	10.4	97
06/03/03	34-0186	02:50	## i	11.4	6.7 c	61.3	39.2	10.3	97
08/05/03	34-0354	03:24	## i	19.7	7.0 c	67.2	43.0	8.5	94
08/06/03	34-0412	12:02	## i	19.3	7.2 c	59.9	38.4	8.8	97
09/09/03	34-0459	03:18	## i	14.5	## i	84.5	54.1	9.4	93
10/01/03	34-0524	12:47	## i	10.9	7.0	52.4	33.6	10.5 u	96 u

**WEST BRANCH MILL RIVER (SARIS: 3419225)****Unique\_ID: W1057 Station: WBMRO1, Mile Point: 0.069**

Description: [Mill Street, Williamsburg]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0136	15:10	0.3	12.3	6.9 c	101	64.4	10.1 u	96 u
06/03/03	34-0185	02:38	## i	11.2	6.8 cu	102	65.5	10.5	98
08/05/03	34-0353	03:14	## i	19.1	7.2 c	104	66.8	8.7	96
08/06/03	34-0411	11:50	## i	19.8	7.4 c	95.2	60.9	8.8	97
09/09/03	34-0458	03:09	## i	14.6	## i	137	87.5	9.6 u	96 u
10/01/03	34-0523	12:37	## i	11.7	7.0	99.2	63.5	10.4 u	97 u

**FORT RIVER (SARIS: 3419425)****Unique\_ID: W1051 Station: 27B, Mile Point: 0.696**

Description: [Route 47, Hadley]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0144	12:42	0.9	14.5	6.9 c	124	79.1	9.8	98
06/03/03	34-0177	02:51	0.5	14.3	6.8	112	71.7	8.9 u	89 u
07/08/03	34-0242	04:10	0.9	22.7	7.1 u	162	105	7.5 i	87 i
08/05/03	34-0345	03:05	0.5	22.3	7.2 uc	170	111	7.5	86
08/06/03	34-0403	10:55	0.5 u	22.1	7.1 c	150	98.0	7.4	85
09/09/03	34-0450	03:15	0.9	17.0	7.2	156	102	8.8	91
10/01/03	34-0515	11:15	0.7	13.2	6.9 u	111	72.0	9.6	91

**MILL RIVER (SARIS: 3419825)****Unique\_ID: W1061 Station: 24B, Mile Point: 2.182**

Description: [Maple Street, Hatfield]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0135	14:29	0.7	14.6	7.1 c	181	116	9.8	98
06/03/03	34-0184	02:06	## i	15.2	6.9 cu	185	118	9.3 u	95 u
08/05/03	34-0352	02:41	## i	22.2	7.1 c	260	167	7.4	86
08/06/03	34-0410	11:11	0.2 i	22.8	7.0 c	225 u	144 u	7.5	89
09/09/03	34-0457	02:37	## i	18.4	## i	269	172	7.6 u	82 u
10/01/03	34-0522	11:54	0.6 i	13.3	6.8 c	136	87.1	9.3	90

**BLOODY BROOK (SARIS: 3420150)****Unique\_ID: W1063 Station: BB01, Mile Point: 1.651**

Description: [Whately Road, Deerfield]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0133	13:09	0.7	12.8 u	6.5	417 iu	267 iu	7.9	76
06/03/03	34-0182	00:51	0.4 i	14.1 u	6.1 c	693 u	444 u	6.9	69
08/05/03	34-0350	01:21	0.4 i	21.4 u	6.4	350	224	2.0	23
08/06/03	34-0408	09:33	0.2 i	21.7	6.4	240	153	3.9 u	45 u
09/09/03	34-0455	01:29	0.3 i	17.0	6.2 i	583 u	373 u	1.6 u	17 u
10/01/03	34-0520	10:16	## i	12.3	6.5 c	305 u	195 u	7.6	72

**MILL RIVER (SARIS: 3420175)****Unique\_ID: W1050 Station: 25C, Mile Point: 0.998**

Description: [Mill River Lane, Hadley]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0134	13:46	0.5	13.6	6.7	194	124	9.5	93
06/03/03	34-0183	01:33	## i	13.7	6.5 c	193	123	8.3	82
08/05/03	34-0351	02:03	## i	21.7	6.8	193 u	124 u	7.0	81
08/06/03	34-0409	10:28	0.6 i	21.4	6.7	208	133	6.2	71
09/09/03	34-0456	02:03	## i	17.6	6.6 i	189	121	8.0 u	85 u
10/01/03	34-0521	11:05	0.6 i	12.4	6.6 c	152 u	97.0 u	8.9 u	84 u

**SAWMILL RIVER (SARIS: 3420550)****Unique\_ID: W1048 Station: 26A, Mile Point: 2.516**

Description: [South Ferry Road, Montague]

Date	OWMID	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond@ 25°C (uS/cm)	TDS (mg/L)	DO (mg/L)	SAT (%)
04/29/03	34-0131	11:33	0.3	12.0	6.7	76.0	48.6	10.6	100
06/03/03	34-0181	00:00	## i	13.2	6.5 c	70.7	45.3	10.0	97
08/05/03	34-0349	00:43	## i	20.4	6.9 uc	79.9	51.1	8.4	94
08/06/03	34-0407	08:43	0.1 i	20.1	6.7	61.3	39.2	8.7	97
09/09/03	34-0454	01:01	## i	16.0	6.8 i	99.9	63.9	9.2	94
10/01/03	34-0519	09:17	## i	11.7	6.6 c	63.3	40.5	10.4	96

## Data Table 2: Connecticut River Watershed Survey 2003 Water Quality Data

(Note: Symbols and Qualifiers Used for DWM Data can be found in Appendix 3.)

### Connecticut, (2003) (QC Status: 4) Exported: 10/4/2005 3:16:02 PM

#### WESTFIELD RIVER (SARIS: 3208250)

Unique\_ID: W0474 Station: CT02, Mile Point: 2.244

Description: [Route 147 bridge, Agawam/West Springfield.]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0148	--	08:35	--	--	0.46* mr	--	--	--	0.09 mrd	--	--	0.037 mr	<2.0* mr
06/04/03	34-0226	--	08:37	--	--	0.53*	--	--	--	0.14	--	--	0.035	3*
07/09/03	34-0285	--	13:50	--	--	0.45*	--	--	--	<0.02	--	--	0.031	<2*
08/06/03	34-0394	--	12:35	--	--	1.3*	--	--	--	<0.02	--	--	0.053	10*
09/10/03	34-0499	--	12:36	--	--	0.43* f	--	--	--	0.08	0.56	0.88 bh	0.056	<2*
10/01/03	34-0564	--	08:30	--	--	1.2*	--	--	--	<0.06	0.27 f	0.93 fh	0.038 h	9*

#### DEERFIELD RIVER (SARIS: 3312900)

Unique\_ID: W0476 Station: CT04, Mile Point: 1.119

Description: [Route 5/10 bridge, Deerfield/Greenfield. Center of approximately 300 foot wide stream.]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0164	--	09:30	--	--	0.58*	--	--	--	<0.02	--	--	0.009	<2.0*
06/04/03	34-0229	--	09:15	--	--	0.37*	--	--	--	<0.02	--	--	0.015	<2*
07/09/03	34-0287	--	08:19	--	--	0.35*	--	--	--	0.06	--	--	0.015	<2*
08/06/03	34-0397	--	09:15	--	--	0.99*	--	--	--	<0.02	--	--	0.029	6*
09/10/03	34-0501	--	09:09	--	--	0.35* f	--	--	--	<0.02	0.25	0.55 bh	0.013	<2*
10/01/03	34-0567	--	09:45	--	--	1.0*	--	--	--	<0.02	0.18 f	0.71 fh	0.022 h	7*

#### CONNECTICUT RIVER (SARIS: 3417100)

Unique\_ID: W0478 Station: CT06, Mile Point: 64.425

Description: [Route 10 bridge, Northfield.]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0159	--	08:00	2*	1*	1.4*	--	--	--	<0.06	--	--	0.021	5.2*
06/04/03	34-0202	--	08:05	20*	5*	0.40*	26	37	--	<0.02	--	--	0.016	2*
07/09/03	34-0314	--	08:20	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0260	--	08:15	30*	16*	0.46*	28	44	--	<0.02	--	--	0.011	<2*
08/06/03	34-0370	--	07:45	250*	30*	1.0*	25	33	1.0*	0.11	--	--	0.019	4*
09/10/03	34-0475	--	08:00	4*	2*	--	--	--	<1.0*	<0.02	0.17	0.42 bh	0.010	<2*
10/01/03	34-0540	--	08:20	500*	120*	--	--	--	--	<0.02	0.14 f	0.72 fh	0.025 h	6*

**CONNECTICUT RIVER (SARIS: 3417100)****Unique\_ID: W1044 Station: 02A, Mile Point: 58.772**

Description: [downstream of Fourmile Brook confluence, Northfield and east of Pisgah Mountain Road, Gill]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
07/09/03	34-0273	--	09:09j	24*	20*	--	--	--	--	--	--	--	--	--
07/09/03	34-0274	--	09:09j	40*	12*	--	--	--	--	--	--	--	--	--
07/09/03	34-0308	34-0309	09:09j	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0309	34-0308	09:09j	--	--	--	--	--	1.1*	--	--	--	--	--
07/09/03	34-0270	34-0271	09:09	30*	10*	0.50*	30	44	--	<0.06	--	--	0.011	<2*
07/09/03	34-0271	34-0270	09:09	30*	10*	0.56*	30	43	--	0.06	--	--	0.011	<2*
08/06/03	34-0383	--	07:52j	500*	160*	--	--	--	--	--	--	--	--	--
08/06/03	34-0384	--	07:52j	600*	70*	--	--	--	--	--	--	--	--	--
08/06/03	34-0380	34-0381	07:55	1900*	130*	1.3*	23 d	29	1.3*	<0.02	--	--	0.020	2*
08/06/03	34-0381	34-0380	07:55	1700*	100*	1.3*	12 d	29	1.1*	<0.02	--	--	0.019	2*
09/10/03	34-0488	--	08:12j	10*	8*	--	--	--	--	--	--	--	--	--
09/10/03	34-0489	--	08:12j	12*	10*	--	--	--	--	--	--	--	--	--
09/10/03	34-0485	34-0486	08:15	<2*	<2*	--	--	--	1.6*	<0.02	0.16	0.54 bh	0.008	<2*
09/10/03	34-0486	34-0485	08:15	12*	6*	--	--	--	1.7*	<0.02	0.16	0.51 bh	0.008	<2*

Note: The following bacteria samples (identified by the OWMID number) were collected from the left side of the river:

34-0273, 34-0383, 34-0488

The following bacteria samples (identified by the OWMID number) were collected from the right side of the river:

34-0274, 34-0384, 34-0489

The following bacteria samples (identified by the OWMID number) were collected from the center of the river:

34-0270, 34-0271, 34-0380, 34-0381, 34-0485, 34-0486

The purpose in collecting three samples along a transect was to determine if there was any variability in water quality conditions as a result of incomplete mixing below a discharge.

**CONNECTICUT RIVER (SARIS: 3417100)****Unique\_ID: W1045 Station: 04A, Mile Point: 40.229**

Description: [Route 116, Deerfield/Sunderland]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0166	--	10:35	10*	2*	1.3*	--	--	--	<0.02	--	--	0.029	10.0*
06/04/03	34-0217	--	10:40	10*	4*	0.44*	23	34	--	<0.02	--	--	0.016	4*
07/09/03	34-0276	--	10:20j	20*	<2*	--	--	--	--	--	--	--	--	--
07/09/03	34-0277	--	10:20j	30*	8*	--	--	--	--	--	--	--	--	--
07/09/03	34-0311	--	10:20j	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0275	--	10:20	10*	<2*	0.30*	28	41	--	<0.02	--	--	0.012	<2*
08/06/03	34-0386	--	09:52j	400*	50*	--	--	--	--	--	--	--	--	--
08/06/03	34-0387	--	09:52j	450*	80*	--	--	--	--	--	--	--	--	--
08/06/03	34-0385	--	09:55	460*	60*	0.51*	23	31	<1.0*	<0.02	--	--	0.016	3*
09/10/03	34-0491	--	09:42j	20*	4*	--	--	--	--	--	--	--	--	--
09/10/03	34-0492	--	09:42j	30*	8*	--	--	--	--	--	--	--	--	--
09/10/03	34-0490	--	09:45	6*	4*	--	--	--	<1.0*	<0.02	0.19	0.50 bh	0.008	<2*

Note: The following bacteria samples (identified by the OWMID number) were collected from the left side of the river:

34-0276, 34-0386, 34-0491

The following bacteria samples (identified by the OWMID number) were collected from the right side of the river:

34-0277, 34-0387, 34-0491

The following bacteria samples (identified by the OWMID number) were collected from the center of the river:

34-0275, 34-0385, 34-0490

The purpose in collecting three samples along a transect was to determine if there was any variability in water quality conditions as a result of incomplete mixing below a discharge.

#### CONNECTICUT RIVER (SARIS: 3417100)

Unique\_ID: W1046 Station: 04C, Mile Point: 22.403

Description: [upstream of the confluence of the Mill River, near the Oxbow, Northampton/Hadley]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
07/09/03	34-0279	--	11:21j	820*	50*	--	--	--	--	--	--	--	--	--
07/09/03	34-0280	--	11:21j	260*	50*	--	--	--	--	--	--	--	--	--
07/09/03	34-0312	--	11:21j	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0278	--	11:26	700*	22*	0.83*	27	39	--	<0.02	--	--	0.015	<2*
08/06/03	34-0389	--	10:41j	3100*	450*	--	--	--	--	--	--	--	--	--
08/06/03	34-0390	--	10:41j	1200*	250*	--	--	--	--	--	--	--	--	--
08/06/03	34-0388	--	10:45	2000*	410*	0.87*	25	31	1.3*	<0.02	--	--	0.026	3*
09/10/03	34-0494	--	10:37j	32*	2*	--	--	--	--	--	--	--	--	--
09/10/03	34-0495	--	10:37j	50*	18*	--	--	--	--	--	--	--	--	--
09/10/03	34-0493	--	10:40	30*	18*	--	--	--	1.1*	<0.02	0.20	0.59 bh	0.012	<2*

Note: The following bacteria samples (identified by the OWMID number) were collected from the left side of the river:

34-0279, 34-0389, 34-0494

The following bacteria samples (identified by the OWMID number) were collected from the right side of the river:

34-0280, 34-0390, 34-0495

The following bacteria samples (identified by the OWMID number) were collected from the center of the river:

34-0281, 34-0391, 34-0493

The purpose in collecting three samples along a transect was to determine if there was any variability in water quality conditions as a result of incomplete mixing below a discharge.

#### CONNECTICUT RIVER (SARIS: 3417100)

Unique\_ID: W1047 Station: 05A, Mile Point: 9.947

Description: [Route 90, West Springfield/Chicopee]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
07/09/03	34-0282	--	12:26j	230*	12*	--	--	--	--	--	--	--	--	--
07/09/03	34-0283	--	12:26j	390*	22*	--	--	--	--	--	--	--	--	--
07/09/03	34-0313	--	12:26j	--	--	--	--	--	1.4*	--	--	--	--	--
07/09/03	34-0281	--	12:26	220*	12*	0.49*	27	40	--	<0.06	--	--	0.026	<2*
08/06/03	34-0392	--	11:38j	1800*	200*	--	--	--	--	--	--	--	--	--
08/06/03	34-0393	--	11:38j	10400*	330*	--	--	--	--	--	--	--	--	--
08/06/03	34-0391	--	11:40	2000*	150*	0.66*	27	35	1.0*	<0.02	--	--	0.027	2*
09/10/03	34-0497	--	11:42j	182*	114*	--	--	--	--	--	--	--	--	--
09/10/03	34-0498	--	11:42j	200*	86*	--	--	--	--	--	--	--	--	--
09/10/03	34-0496	--	11:42	96*	50*	--	--	--	1.7*	<0.06	0.21	0.55 bh	0.022	<2*

Note: The following bacteria samples (identified by the OWMID number) were collected from the left side of the river:

34-0282, 34-0392, 34-0497

The following bacteria samples (identified by the OWMID number) were collected from the right side of the river:

34-0283, 34-0393, 34-0498

The following bacteria samples (identified by the OWMID number) were collected from the center of the river:

34-0281, 34-0391, 34-0496

The purpose in collecting three samples along a transect was to determine if there was any variability in water quality conditions as a result of incomplete mixing below a discharge.

#### CONNECTICUT RIVER (SARIS: 3417100)

Unique\_ID: W1395 Station: CT00, Mile Point: -2.994

Description: [At the USGS flow gaging station #01184000 downstream of Route 190, Suffield/Enfield Connecticut (The point in Arcview is as close as the MA state quad image allows, actual point is further downstream.)]

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100mL	E.coli CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
04/30/03	34-0147	--	08:01	27*	1*	0.95*	--	--	--	<0.02 d	--	--	0.029	8.0*
06/04/03	34-0192	--	08:05	110*	28*	0.57*	22	35	--	0.08	--	--	0.039	4*
07/09/03	34-0319	34-0320	08:25j	--	--	--	--	--	** *	--	--	--	--	--
07/09/03	34-0320	34-0319	08:25j	--	--	--	--	--	** *	--	--	--	--	--
07/09/03	34-0250	--	08:20	14*	<10*	2.3*	27	43	--	<0.06 p	--	--	0.058 pd	<2*
08/06/03	34-0418	34-0419	08:00j	--	--	--	--	--	1.7*	--	--	--	--	--
08/06/03	34-0419	34-0418	08:00j	--	--	--	--	--	1.6*	--	--	--	--	--
09/10/03	34-0465	--	08:47	120*	66*	--	--	--	2.3*	<0.02	0.28	0.61 bh	0.036	<2*
10/01/03	34-0530	--	08:00	1100*	210*	1.3*	--	--	--	<0.06	0.24 f	0.96 fh	0.055	14*

#### STONY BROOK (SARIS: 3417925)

Unique\_ID: W1053 Station: 19A, Mile Point: 2.277

Description: [College Street (Route 116) upstream of confluence of Leaping Well Brook, South Hadley]

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100mL	E.coli CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
04/30/03	34-0154	--	10:41	98*	75*	1.1*	--	--	--	<0.02 d	--	--	0.019	<2.0*
06/04/03	34-0197	--	10:27	256*	145*	2.2*	--	--	--	<0.02	--	--	0.053	3*
07/09/03	34-0255	--	10:35	2760*	600*	5.6*	--	--	--	<0.02	--	--	0.079 d	4*
08/06/03	34-0365	--	10:00	1200*	940*	5.8*	--	--	--	<0.06	--	--	0.071	6*
09/10/03	34-0470	--	10:33	560*	190*	--	--	--	** *	<0.06	--	--	0.045	2*
10/01/03	34-0535	--	10:30	800*	510*	2.1*	--	--	--	<0.02	--	--	0.056 h	3*

#### BACHELOR BROOK (SARIS: 3418000)

Unique\_ID: W1052 Station: 07A, Mile Point: 0.916

Description: [Route 47 (Hadley Street), South Hadley]

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100mL	E.coli CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
04/30/03	34-0155	--	10:53	16*	1*	1.0*	--	--	--	<0.02 d	--	--	0.024	4.4*
06/04/03	34-0198	--	10:43	180*	100*	1.2*	--	--	--	<0.02	--	--	0.054	14*
07/09/03	34-0256	--	10:56	800*	200*	2.0*	--	--	--	0.07	--	--	0.062 d	5*
08/06/03	34-0366	--	10:26	1100*	580*	2.1*	--	--	1.3*	<0.02	--	--	0.047	8*



09/10/03	34-0471	--	10:52	220*	76*	--	--	--	<1.0*	<0.06	--	--	0.027	<2*
10/01/03	34-0536	--	10:50	200*	20*	1.1*	--	--	** *	<0.02	--	--	0.035 h	5*

**WESTON BROOK (SARIS: 3418100)**

**Unique\_ID: W1054 Station: 23A, Mile Point: 0.441**

Description: [Rural Street, Belchertown]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0150	--	09:50	17*	<0.9*	0.79*	--	--	--	<0.02 d	--	--	0.056	3.6*
06/04/03	34-0193	--	09:38	78*	57*	0.91*	--	--	--	<0.06	--	--	0.098	3*
07/09/03	34-0251	--	09:26	370*	210*	2.5*	--	--	--	<0.02 p	--	--	0.16 pd	8*
08/06/03	34-0361	--	08:55	800*	420*	2.1*	--	--	--	<0.02	--	--	0.17	10*
09/10/03	34-0466	--	09:44	72*	70*	--	--	--	** *	<0.06	--	--	0.068	<2*
10/01/03	34-0531	--	09:35	150*	30*	0.87*	--	--	--	<0.02	--	--	0.078 h	<2*

**LAMPSON BROOK (SARIS: 3418125)**

**Unique\_ID: W1055 Station: 06A, Mile Point: 0.907**

Description: [George Hannum Street, approximately 50 feet downstream of Belchertown WWTP (MA0102148) discharge, Belchertown]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0151	34-0152	10:06	15*	<0.9*	0.61*	--	--	--	## d	--	--	0.071	<2.0*
04/30/03	34-0152	34-0151	10:06	16*	<0.9*	0.63*	--	--	--	## d	--	--	0.074	2.4*
06/04/03	34-0194	34-0195	09:50	86*	44*	0.95*	--	--	--	0.10	--	--	0.10	2*
06/04/03	34-0195	34-0194	09:50	60*	37*	0.93*	--	--	--	0.09	--	--	0.11	2*
07/09/03	34-0252	34-0253	09:54	140*	90*	1.7*	--	--	--	<0.06	--	--	## d	5* d
07/09/03	34-0253	34-0252	09:54	350*	80*	1.7*	--	--	--	0.07	--	--	## d	10* d
08/06/03	34-0363	34-0364	09:22	330*	310*	2.2*	--	--	--	<0.06	--	--	0.12	6*
08/06/03	34-0364	34-0363	09:22	310*	150*	2.1*	--	--	--	<0.02	--	--	0.14	6*
09/10/03	34-0467	34-0468	10:00	500* d	32*	--	--	--	** *	0.12	--	--	0.37	12*
09/10/03	34-0468	34-0467	10:00	140* d	36*	--	--	--	** *	0.14	--	--	0.37	13*
10/01/03	34-0532	34-0533	09:55	100*	50*	2.2*	--	--	--	<0.02	--	--	0.12 h	6*
10/01/03	34-0533	34-0532	09:55	60*	60*	2.2*	--	--	--	<0.06	--	--	0.12 h	6*

**MANHAN RIVER (SARIS: 3418175)**

**Unique\_ID: W1064 Station: 11A, Mile Point: 5.633**

Description: [Loudville Road, Easthampton]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0157	--	12:22	20*	<0.9*	0.95*	--	--	--	<0.02 d	--	--	0.018	4.4*
06/04/03	34-0201	--	12:09	180*	167*	1.0*	--	--	--	<0.02	--	--	0.031	5*
07/09/03	34-0259	--	13:05	1820*	1120*	1.2*	--	--	--	<0.02	--	--	0.035 d	3*
08/06/03	34-0369	--	12:05	2500*	780*	2.7*	--	--	2.1*	<0.06	--	--	0.061	11*
09/10/03	34-0474	--	12:35	70*	46*	--	--	--	<1.0*	<0.06	--	--	0.019	<2*
10/01/03	34-0539	--	12:10	400*	160*	1.7*	--	--	--	<0.06	--	--	0.043 h	16*

**MANHAN RIVER (SARIS: 3418175)****Unique\_ID: W1065 Station: 11C, Mile Point: 0.842**

Description: [Fort Hill Road, Easthampton]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0158	--	11:59	58*	5*	1.3*	--	--	--	0.06 d	--	--	0.029	3.6*
06/04/03	34-0200	--	11:46	170*	168*	1.4*	--	--	--	0.08	--	--	0.043	8*
07/09/03	34-0258	--	12:35	590*	260*	1.5*	--	--	--	0.07	--	--	0.066 d	6*
08/06/03	34-0368	--	11:35	3700*	720*	4.5*	--	--	5.1*	<0.06	--	--	0.099	31*
09/10/03	34-0473	--	11:53	260*	210*	--	--	--	1.8*	0.08	--	--	0.027	2*
10/01/03	34-0538	--	11:50	600*	460*	3.2*	--	--	--	0.08	--	--	0.067 h	20*

**MILL RIVER (SARIS: 3418825)****Unique\_ID: W1059 Station: 28B, Mile Point: 0.611**

Description: [approximately 1 mile downstream of Clement Street (location of USGS gage 01171500 prior to October 2002), Northampton]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0171	--	12:40	18*	3*	0.46*	--	--	--	<0.02	--	--	0.011	<2.0*
06/04/03	34-0211	--	13:03	190*	93*	0.54*	--	--	--	<0.06	--	--	0.021	2*
07/09/03	34-0269	--	12:45	830*	610*	0.56*	--	--	--	<0.02	--	--	0.024	<2*
08/06/03	34-0379	--	12:50	6200*	1180*	1.9*	--	--	--	<0.02	--	--	0.045	13*
09/10/03	34-0484	--	12:01	260*	184*	--	--	--	--	<0.02	0.46	0.80 bh	0.013	<2*
10/01/03	34-0549	--	13:25	230*	150*	--	--	--	--	<0.02	0.33 f	0.93 fh	0.021 h	<2*

**EAST BRANCH MILL RIVER (SARIS: 3419150)****Unique\_ID: W1056 Station: EBMR01, Mile Point: 0.038**

Description: [south of East Main Street approximately 200 feet from confluence with West Branch Mill River, Williamsburg]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0170	--	11:55	4*	<0.9*	0.31*	--	--	--	<0.02	--	--	<0.005	<2.0*
06/04/03	34-0210	--	12:30	50*	20*	0.33*	--	--	--	<0.06	--	--	0.012	<2*
07/09/03	34-0268	--	12:05	1880*	1370*	0.30*	--	--	--	<0.02	--	--	0.011	<2*
08/06/03	34-0378	--	12:03	1600*	210*	0.68*	--	--	--	<0.02	--	--	0.024	4*
09/10/03	34-0483	--	11:10	30*	22*	--	--	--	--	<0.02	--	--	<0.005	<2*
10/01/03	34-0548	--	12:35	100*	50*	--	--	--	--	<0.02	--	--	0.009 h	<2*

**WEST BRANCH MILL RIVER (SARIS: 3419225)****Unique\_ID: W1057 Station: WBMR01, Mile Point: 0.069**

Description: [Mill Street, Williamsburg]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0169	--	11:50	4*	1*	0.23*	--	--	--	<0.02	--	--	0.009	<2.0*
06/04/03	34-0209	--	12:25	58*	49*	0.23*	--	--	--	0.14	--	--	0.007	<2*
07/09/03	34-0267	--	12:00	2280*	1250*	1.0*	--	--	--	<0.02	--	--	0.018	2*
08/06/03	34-0377	--	11:50	1000*	390*	0.77*	--	--	--	<0.02	--	--	0.025	6*
09/10/03	34-0482	--	11:05	72*	72*	--	--	--	--	<0.02	--	--	<0.005	<2*
10/01/03	34-0547	--	12:40	170*	100*	--	--	--	--	<0.02	--	--	0.013 h	<2*

**FORT RIVER (SARIS: 3419425)****Unique\_ID: W1051 Station: 27B, Mile Point: 0.696**

Description: [Route 47, Hadley]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0156	--	11:17	80*	16*	2.6*	--	--	--	<0.02 d	--	--	0.029	8.0*
06/04/03	34-0199	--	11:05	284*	247*	2.5*	--	--	--	0.09	--	--	0.046	8*
07/09/03	34-0257	--	11:24	690*	300*	4.4*	--	--	--	<0.06	--	--	0.058 d	6*
08/06/03	34-0367	--	10:54	12500*	3000*	8.9*	--	--	3.1*	0.08	--	--	0.16	46*
09/10/03	34-0472	--	11:13	672*	234*	--	--	--	<1.0*	<0.06	--	--	0.030	4*
10/01/03	34-0537	--	11:15	800*	320*	4.5*	--	--	--	0.35	--	--	0.10 h	22*

**MILL RIVER (SARIS: 3419825)****Unique\_ID: W1061 Station: 24B, Mile Point: 2.182**

Description: [Maple Street, Hatfield]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0168	--	11:25	15*	<0.9*	0.93*	--	--	--	<0.02	--	--	0.019	<2.0*
06/04/03	34-0208	--	11:33	100*	62*	1.3*	--	--	--	<0.02	--	--	0.036	2*
07/09/03	34-0318	--	11:20j	--	--	--	--	--	1.3*	--	--	--	--	--
07/09/03	34-0266	--	11:15	108* e	200* e	2.5*	--	--	--	<0.06	--	--	0.032	<2*
08/06/03	34-0376	--	11:04	2500*	190*	2.0*	--	--	--	0.11	--	--	0.057	6*
09/10/03	34-0481	--	10:30	272*	208*	--	--	--	--	0.08	--	--	0.027	3*
10/01/03	34-0546	--	11:50	140*	140*	--	--	--	--	0.11	--	--	0.042 h	3*

**BLOODY BROOK (SARIS: 3420150)****Unique\_ID: W1063 Station: BB01, Mile Point: 1.651**

Description: [Whately Road, Deerfield]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0165	--	09:54	50*	36*	1.3*	--	--	--	0.34	--	--	0.058	<2.0*
06/04/03	34-0206	--	10:10	380*	354*	7.4*	--	--	--	0.33	--	--	0.12	9*
07/09/03	34-0264	--	09:40	2680*	140*	11*	--	--	--	0.21	--	--	0.11	9*
08/06/03	34-0374	34-0420	09:44	11500*	2280*	4.9*	--	--	3.2* d	0.11	--	--	0.16	5*
08/06/03	34-0420	34-0374	09:44	--	--	--	--	--	5.7* d	--	--	--	--	--
09/10/03	34-0479	--	09:25	680*	408*	--	--	--	3.4*	0.20	--	--	0.089	12*
10/01/03	34-0544	--	10:10	900*	150*	--	--	--	--	0.10	--	--	0.065 h	2*

**MILL RIVER (SARIS: 3420175)****Unique\_ID: W1050 Station: 25C, Mile Point: 0.998**

Description: [Mill River Lane, Hadley]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0167	--	10:54	32*	4*	1.0*	--	--	--	<0.02	--	--	0.025	2.4*
06/04/03	34-0207	--	11:00	198*	185*	1.0*	--	--	--	<0.02	--	--	0.033	3*
07/09/03	34-0315	34-0316	10:35j	--	--	--	--	--	1.5*	--	--	--	--	--
07/09/03	34-0316	34-0315	10:35j	--	--	--	--	--	1.3*	--	--	--	--	--
07/09/03	34-0265	--	10:35	690*	380*	2.2*	--	--	--	<0.06	--	--	0.034	2*
08/06/03	34-0375	--	10:16	10600*	1950*	4.2*	--	--	--	<0.02	--	--	0.10	18*
09/10/03	34-0480	--	09:55	250*	136*	--	--	--	--	<0.02	--	--	0.026	<2*
10/01/03	34-0545	--	11:00	300*	140*	--	--	--	--	<0.06	--	--	0.038 h	5*

**SAWMILL RIVER (SARIS: 3420550)****Unique\_ID: W1048 Station: 26A, Mile Point: 2.516**

Description: [South Ferry Road, Montague]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0162	34-0161	08:58j	30*	1*	0.30*	--	--	--	<0.02	--	--	0.010	2.0*
04/30/03	34-0161	34-0162	08:58	32*	2*	0.29*	--	--	--	<0.02	--	--	0.010	<2.0*
06/04/03	34-0203	34-0204	09:40	160*	107*	0.32*	--	--	--	<0.02	--	--	0.012	<2*
06/04/03	34-0204	34-0203	09:40	170*	105*	0.31*	--	--	--	<0.02	--	--	0.014 h	2*
07/09/03	34-0261	34-0262	09:05	1050*	408* d	1.2*	--	--	--	<0.02	--	--	0.016	6*
07/09/03	34-0262	34-0261	09:05	1250*	1240* d	0.48*	--	--	--	<0.02	--	--	0.018	4*
08/06/03	34-0371	34-0372	08:35	2200*	680*	1.2*	--	--	--	0.06	--	--	0.038	14*
08/06/03	34-0372	34-0371	08:35	2200*	610*	1.2*	--	--	--	<0.06	--	--	0.035	14*
09/10/03	34-0476	34-0477	09:00	60*	14*	--	--	--	--	<0.02	--	--	0.007	<2*
09/10/03	34-0477	34-0476	09:00	44*	28*	--	--	--	--	<0.02	--	--	0.008	<2*
10/01/03	34-0541	34-0542	09:15	30* m	20* m	--	--	--	--	<0.02	--	--	0.015 h	<2*
10/01/03	34-0542	34-0541	09:15	60* m	40* m	--	--	--	--	<0.02	--	--	0.015 h	<2*

**MILLERS RIVER (SARIS: 3522150)****Unique\_ID: W0477 Station: CT05, Mile Point: 1.811**

Description: [Route 63 bridge, Erving/Montague.]

Date	OWMID	QAQC	Time	Fecal	E.coli	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0160	--	08:40	--	--	0.73*	--	--	--	<0.02	--	--	0.026	<2.0*
06/04/03	34-0228	--	08:45	--	--	0.84*	--	--	--	<0.02	--	--	0.044	4*
07/09/03	34-0286	--	07:40	--	--	1.2*	--	--	--	<0.02	--	--	0.048	<2*
08/06/03	34-0396	--	07:22	--	--	1.5*	--	--	--	<0.02	--	--	0.062	8*
09/10/03	34-0502	--	07:40	--	--	1.1* f	--	--	--	<0.02	0.42	0.96 bh	0.037	<2*
10/01/03	34-0566	--	08:50	--	--	1.5*	--	--	--	<0.02	0.23 f	1.0 fh	0.049 h	3*

**CHICOPEE RIVER (SARIS: 3625000)**

**Unique\_ID: W0475 Station: CT03, Mile Point: 0.839**

Description: [Route 116 bridge, Chicopee.]

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100mL	E.coli CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
04/30/03	34-0149	--	09:18	--	--	0.98*	--	--	--	<0.02 d	--	--	0.024	3.2*
06/04/03	34-0227	--	08:59	--	--	1.1*	--	--	--	<0.06	--	--	0.048	3*
07/09/03	34-0284	--	12:54	--	--	2.0*	--	--	--	<0.02	--	--	0.051	2*
08/06/03	34-0395	--	12:08	--	--	2.5*	--	--	--	<0.02	--	--	0.065	10*
09/10/03	34-0500	--	12:13	--	--	0.99* f	--	--	--	<0.02	0.36	0.76 bh	0.027	<2*
10/01/03	34-0565	--	09:00	--	--	1.5*	--	--	--	<0.06	0.32 f	1.0 fh	0.041 h	<2*

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# Appendix 1: Connecticut River Watershed Survey 2003 Blank QC Sample Results

(Note: Symbols and Qualifiers Used for DWM Data can be found in Appendix 4)

Connecticut, (2003) (QC Status: 4) Exported: 10/11/2005 2:02:44 PM

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100mL	E.coli CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
04/30/03	34-0153	Blank	10:06j	<0.9*	<0.9*	<0.10*	--	--	--	<0.02 d	--	--	<0.005	<2.0*
04/30/03	34-0163	Blank	08:58j	<0.9*	<0.9*	<0.10*	--	--	--	<0.02	--	--	<0.005	<2.0*
06/04/03	34-0196	Blank	09:50j	<2*	<0.9*	<0.10*	--	--	--	<0.02	--	--	<0.005	<2*
06/04/03	34-0205	Blank	09:40j	<2*	<0.9*	<0.10*	--	--	--	<0.02	--	--	<0.005	<2*
07/09/03	34-0254	Blank	09:54j	<2*	<2*	<0.10*	--	--	--	<0.02	--	--	<0.005 d	<2*
07/09/03	34-0263	Blank	09:10j	<2*	<2*	<0.10*	--	--	--	<0.02	--	--	<0.005	<2*
07/09/03	34-0272	Blank	09:09j	<2*	<2*	0.15* b	<2	<0.66	--	<0.06	--	--	<0.005	<2*
07/09/03	34-0310	Blank	09:09j	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0317	Blank	10:35j	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0321	Blank	08:25j	--	--	--	--	--	** *	--	--	--	--	--
08/06/03	34-0373	Blank	08:20j	<10*	<10*	<0.10*	--	--	--	<0.02	--	--	<0.005	<2*
08/06/03	34-0382	Blank	07:52j	<10*	<10*	<0.10*	<2	<0.66	<1.0*	<0.02	--	--	<0.005	<2*
08/06/03	34-0421	Blank	09:30j	--	--	--	--	--	<1.0*	--	--	--	--	--
08/06/03	34-0360	Blank	08:00	[2200*] b	[700*] b	1.7* b	[28] b	[38] b	<1.0*	<0.06	--	--	0.052 b	3* b
08/06/03	34-0362	Blank	09:22	<10*	<10*	<0.10*	--	--	--	<0.02	--	--	<0.005	<2*
09/10/03	34-0469	Blank	10:00j	<2*	<2*	--	--	--	** *	<0.02	--	--	<0.005	<2*
09/10/03	34-0478	Blank	09:00j	<2*	<2*	--	--	--	--	<0.02	--	--	<0.005	<2*
09/10/03	34-0487	Blank	08:12j	<2*	<2*	--	--	--	<1.0*	<0.02	<0.02	0.15 bh	<0.005	<2*
10/01/03	34-0534	Blank	09:55j	<10*	<10*	<0.10*	--	--	--	<0.02	--	--	<0.005 h	<2*
10/01/03	34-0543	Blank	09:15j	<10*	<10*	--	--	--	--	<0.02	--	--	<0.005 h	<2*

## Appendix 2: Connecticut River Watershed Survey 2002 Relative Percent Difference Results

(Note: Symbols and Qualifiers Used for DWM Data can be found in Appendix 4)

Connecticut, (2003) (QC Status: 4) Exported: 10/12/2005 3:04:34 PM

CONNECTICUT RIVER (SARIS: 3417100)

Unique\_ID: W1044 Station: 02A, Mile Point: 58.772

Description: [downstream of Fourmile Brook confluence, Northfield and east of Pisgah Mountain Road, Gill]

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100mL	Log10(E.coli) CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
07/09/03	34-0308	34-0309	09:09j	--	--	--	--	--	<1.0*	--	--	--	--	--
07/09/03	34-0309	34-0308	09:09j	--	--	--	--	--	1.1*	--	--	--	--	--
07/09/03	34-0270	34-0271	09:09	1.477*	1.000*	0.50*	30	44	--	<0.06	--	--	0.011	<2*
07/09/03	34-0271	34-0270	09:09	1.477*	1.000*	0.56*	30	43	--	0.06	--	--	0.011	<2*
Relative	Percent	Difference		0.0%	0.0%	11.3%	0.0%	2.3%	9.5%	0.0%	--	--	0.0%	0.0%
08/06/03	34-0380	34-0381	07:55	3.279*	2.114*	1.3*	23 d	29	1.3*	<0.02	--	--	0.020	2*
08/06/03	34-0381	34-0380	07:55	3.230*	2.000*	1.3*	12 d	29	1.1*	<0.02	--	--	0.019	2*
Relative	Percent	Difference		1.5%	5.5%	0.0%	62.9%	0.0%	16.7%	0.0%	--	--	5.1%	0.0%
09/10/03	34-0485	34-0486	08:15	0.301*	0.301*	--	--	--	1.6*	<0.02	0.16	0.54 bh	0.008	<2*
09/10/03	34-0486	34-0485	08:15	1.079*	0.778*	--	--	--	1.7*	<0.02	0.16	0.51 bh	0.008	<2*
Relative	Percent	Difference		112.8%	88.4%	--	--	--	6.1%	0.0%	0.0%	5.7%	0.0%	0.0%

CONNECTICUT RIVER (SARIS: 3417100)

Unique\_ID: W1395 Station: CT00, Mile Point: -2.994

Description: [At the USGS flow gaging station #01184000 downstream of Route 190, Suffield/Enfield Connecticut (The point in Arcview is as close as the MA state quad image allows, actual point is further downstream.)]

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100mL	Log10(E.coli) CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
07/09/03	34-0319	34-0320	08:25j	--	--	--	--	--	** *	--	--	--	--	--
07/09/03	34-0320	34-0319	08:25j	--	--	--	--	--	** *	--	--	--	--	--
Relative	Percent	Difference		--	--	--	--	--	--	--	--	--	--	--
08/06/03	34-0418	34-0419	08:00j	--	--	--	--	--	1.7*	--	--	--	--	--
08/06/03	34-0419	34-0418	08:00j	--	--	--	--	--	1.6*	--	--	--	--	--
Relative	Percent	Difference		--	--	--	--	--	6.1%	--	--	--	--	--



**LAMPSON BROOK (SARIS: 3418125)****Unique\_ID: W1055 Station: 06A, Mile Point: 0.907**

Description: [George Hannum Street, approximately 50 feet downstream of Belchertown WWTP (MA0102148) discharge, Belchertown]

Date	OWMID	QAQC	Time	Log10(Fecal)	Log10(E.coli)	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
04/30/03	34-0151	34-0152	10:06	1.176*	-0.046*	0.61*	--	--	--	## d	--	--	0.071	<2.0*
04/30/03	34-0152	34-0151	10:06	1.204*	-0.046*	0.63*	--	--	--	## d	--	--	0.074	2.4*
Relative	Percent	Difference		2.4%	0.0%	3.2%	--	--	--	--	--	--	4.1%	18.2%
06/04/03	34-0194	34-0195	09:50	1.934*	1.643*	0.95*	--	--	--	0.10	--	--	0.10	2*
06/04/03	34-0195	34-0194	09:50	1.778*	1.568*	0.93*	--	--	--	0.09	--	--	0.11	2*
Relative	Percent	Difference		8.4%	4.7%	2.1%	--	--	--	10.5%	--	--	9.5%	0.0%
07/09/03	34-0252	34-0253	09:54	2.146*	1.954*	1.7*	--	--	--	<0.06	--	--	## d	5* d
07/09/03	34-0253	34-0252	09:54	2.544*	1.903*	1.7*	--	--	--	0.07	--	--	## d	10* d
Relative	Percent	Difference		17.0%	2.7%	0.0%	--	--	--	15.4%	--	--	--	66.7%
08/06/03	34-0363	34-0364	09:22j	2.519*	2.491*	2.2*	--	--	--	<0.06	--	--	0.12	6*
08/06/03	34-0364	34-0363	09:22j	2.491*	2.176*	2.1*	--	--	--	<0.02	--	--	0.14	6*
Relative	Percent	Difference		1.1%	13.5%	4.7%	--	--	--	100.0%	--	--	15.4%	0.0%
09/10/03	34-0467	34-0468	10:00	2.699* d	1.505*	--	--	--	** *	0.12	--	--	0.37	12*
09/10/03	34-0468	34-0467	10:00	2.146* d	1.556*	--	--	--	** *	0.14	--	--	0.37	13*
Relative	Percent	Difference		22.8%	3.3%	--	--	--	--	15.4%	--	--	0.0%	8.0%
10/01/03	34-0532	34-0533	09:55	2.000*	1.699*	2.2*	--	--	--	<0.02	--	--	0.12 h	6*
10/01/03	34-0533	34-0532	09:55	1.778*	1.778*	2.2*	--	--	--	<0.06	--	--	0.12 h	6*
Relative	Percent	Difference		11.7%	4.6%	0.0%	--	--	--	100.0%	--	--	0.0%	0.0%

**BLOODY BROOK (SARIS: 3420150)****Unique\_ID: W1063 Station: BB01, Mile Point: 1.651**

Description: [Whately Road, Deerfield]

Date	OWMID	QAQC	Time	Log10(Fecal)	Log10(E.coli)	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
08/06/03	34-0374	34-0420	09:44	4.061*	3.358*	4.9*	--	--	3.2* d	0.11	--	--	0.16	5*
08/06/03	34-0420	34-0374	09:44	--	--	--	--	--	5.7* d	--	--	--	--	--
Relative	Percent	Difference		--	--	--	--	--	56.2%	--	--	--	--	--

**MILL RIVER (SARIS: 3420175)****Unique\_ID: W1050 Station: 25C, Mile Point: 0.998**

Description: [Mill River Lane, Hadley]

Date	OWMID	QAQC	Time	Log10(Fecal)	Log10(E.coli)	Turb	Alk	Hard	Chl-a	NH3-N	NO3-NO2-N	TN	TP	TSS
			(24hr)	CFU/100mL	CFU/100mL	NTU	mg/L	mg/L	mg/m3	mg/L	mg/L	mg/L	mg/L	mg/L
07/09/03	34-0315	34-0316	10:35j	--	--	--	--	--	1.5*	--	--	--	--	--
07/09/03	34-0316	34-0315	10:35j	--	--	--	--	--	1.3*	--	--	--	--	--
Relative	Percent	Difference		--	--	--	--	--	14.3%	--	--	--	--	--

**SAWMILL RIVER (SARIS: 3420550)**
**Unique\_ID: W1048 Station: 26A, Mile Point: 2.516**
**Description: [South Ferry Road, Montague]**

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100mL	Log10(E.coli) CFU/100mL	Turb NTU	Alk mg/L	Hard mg/L	Chl-a mg/m3	NH3-N mg/L	NO3-NO2-N mg/L	TN mg/L	TP mg/L	TSS mg/L
04/30/03	34-0162	34-0161	08:58j	1.477*	0.000*	0.30*	--	--	--	<0.02	--	--	0.010	2.0*
04/30/03	34-0161	34-0162	08:58	1.505*	0.301*	0.29*	--	--	--	<0.02	--	--	0.010	<2.0*
Relative	Percent	Difference		1.9%	200.0%	3.4%	--	--	--	0.0%	--	--	0.0%	0.0%
06/04/03	34-0203	34-0204	09:40	2.204*	2.029*	0.32*	--	--	--	<0.02	--	--	0.012	<2*
06/04/03	34-0204	34-0203	09:40	2.230*	2.021*	0.31*	--	--	--	<0.02	--	--	0.014 h	2*
Relative	Percent	Difference		1.2%	0.4%	3.2%	--	--	--	0.0%	--	--	15.4%	0.0%
07/09/03	34-0261	34-0262	09:05	3.021*	2.611* d	1.2*	--	--	--	<0.02	--	--	0.016	6*
07/09/03	34-0262	34-0261	09:05	3.097*	3.093* d	0.48*	--	--	--	<0.02	--	--	0.018	4*
Relative	Percent	Difference		2.5%	16.9%	85.7%	--	--	--	0.0%	--	--	11.8%	40.0%
08/06/03	34-0371	34-0372	08:35	3.342*	2.833*	1.2*	--	--	--	0.06	--	--	0.038	14*
08/06/03	34-0372	34-0371	08:35	3.342*	2.785*	1.2*	--	--	--	<0.06	--	--	0.035	14*
Relative	Percent	Difference		0.0%	1.7%	0.0%	--	--	--	0.0%	--	--	8.2%	0.0%
09/10/03	34-0476	34-0477	09:00	1.778*	1.146*	--	--	--	--	<0.02	--	--	0.007	<2*
09/10/03	34-0477	34-0476	09:00	1.643*	1.447*	--	--	--	--	<0.02	--	--	0.008	<2*
Relative	Percent	Difference		7.9%	23.2%	--	--	--	--	0.0%	--	--	13.3%	0.0%
10/01/03	34-0541	34-0542	09:15	1.477* m	1.301* m	--	--	--	--	<0.02	--	--	0.015 h	<2*
10/01/03	34-0542	34-0541	09:15	1.778* m	1.602* m	--	--	--	--	<0.02	--	--	0.015 h	<2*
Relative	Percent	Difference		18.5%	20.7%	--	--	--	--	0.0%	--	--	0.0%	0.0%

### Appendix 3: Symbols and Qualifiers Used for DWM Data

*The following data qualifiers or symbols are used in the MADEP/DWM WQD database for qualified and censored water quality and multi-probe data. Decisions regarding censoring vs. qualification for specific, problematic data are made based on a thorough review of all pertinent information related to the data.*

#### **General Symbols (applicable to all types):**

*“##” = Censored data (i.e., data that has been discarded for some reason). NOTE: Prior to 2001 data, “\*\*” denoted either censored or missing data.*

*“\*” = Missing data (i.e., data that should have been reported). See NOTE above.*

*“--” = No data (i.e., data not taken/not required)*

*\* = Analysis performed by Laboratory OTHER than DEP’s Wall Experiment Station (WES)*

*[ ] = A result reported inside brackets has been “censored”, but is shown for informational purposes (e.g., high blank results).*

#### **Multi-probe-specific Qualifiers:**

*“i” = inaccurate readings from multi-probe likely; may be due to significant pre-survey calibration problems, post-survey checks outside typical acceptance ranges for the low ionic and deionized water checks, lack of calibration of the depth sensor prior to use, or to checks against laboratory analyses. Where documentation on unit pre-calibration is lacking, but SOPs at the time of sampling dictated pre-calibration prior to use, then data are considered potentially inaccurate.*

### **Qualification Criteria for Depth (i):**

#### **General Depth Criteria:** Apply to each OWMID#

- Clearly erroneous readings due to faulty depth sensor: Censor (i)
- Negative and zero depth readings: Censor (i); (likely in error)
- 0.1 m depth readings: Qualify (i); (potentially in error)
- 0.2 and greater depth readings: Accept without qualification; (likely accurate)

#### **Specific Depth Criteria:** Apply to entirety of depth data for survey date

- If zero and/or negative depth readings occur more than once per survey date, censor all negative/zero depth data, and qualify all other depth data for that survey (indicates that erroneous depth readings were not recognized in the field and that corrective action (field calibration of the depth sensor) was not taken, i.e. that all positive readings may be in error.)

“ m ” = method not followed; one or more protocols contained in the DWM multi-probe SOP not followed, ie. operator error (eg. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

“ s ” = field sheet recorded data were used to accept data (i.e., not data electronically recorded in a data logger or in cases where data logging is not possible (e.g., single-probes)).

“ u ” = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.

“ c ” = unit not calibrated for a particular parameter and/or greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified (“c”) conductivity data, or that the calculation was not possible due to censored conductivity data ( TDS and Salinity are calculated values and entirely based on conductivity reading). See Section 4.1 for acceptance criteria.

“ r ” = data not representative of actual field conditions.

“ ? ” = Light interference on Turbidity sensor (Multi-probe error message). Data is typically censored.

#### **Sample-Specific Qualifiers:**

“ a ” = accuracy as estimated at WES Lab via matrix spikes, PT sample recoveries, internal check standards and lab-fortified blanks did not meet project data quality objectives identified for program or in QAPP.

“ b ” = blank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).

“ d ” = precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.

“ e ” = not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria, for lake Secchi and station depth data where a specific Secchi depth is greater than the reported station depth, and for other incongruous or conflicting results.

“ f ” = frequency of quality control duplicates did not meet data quality objectives identified for program or in QAPP.

“ h ” = holding time violation (usually indicating possible bias low)

“ j ” = ‘estimated’ value; used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the ‘reporting’ limit or RDL and greater than the method detection limit or MDL ( $mdl < x < rdl$ ). Also used to note where values have been reported at levels less than the mdl.

“ m ” = method SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (eg. sediment in sample, floc formation), lab error (eg. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, and missing data.

“ p ” = samples not preserved per SOP or analytical method requirements.

*“r” = samples collected may not be representative of actual field conditions, including the possibility of “outlier” data and flow-limited conditions (e.g., pooled).*